Employer Has the Right to Influence Workers

AN EDITORIAL

NATURALLY enough both management and workers are questioning some matters in industrial relations formerly taken for granted.

First step is to wonder if workers shouldn't be let strictly alone to do what they want about organization and collective bargaining.

But developing the idea brings under consideration such matters as condition of workplaces, safety, recreation, training.

And from there it's only a step to questioning the right of employers to try to influence their employees' thinking on economics and government.

The answer is clear to us. It is that everything the country has comes out of what it produces; that, for the sake of wide distribution, production must be carried on at cost as low as possible; that those industrial relations policies which make for efficient operation, with due regard to fair treatment of worker and stockholder, must be continued.

These policies include, in many plants, participation in pension plans, group insurance, safety programs, employee representation plans, training, recreational and educational activities.

Where the employer is convinced that it is to the interest of production (from the standpoint of standard of living) to carry on these activities, he should do so in cooperation with his employees.

If he is convinced that the social objectives to which he has subscribed are endangered by the teachings and preachings of others, it is his right—even his duty—to do teaching and preaching of his own.

Quiet on the Toledo Front

Public opinion, focused by the press, has forced employers and labor to form a peace board to end Toledo's epidemic of strikes

FRANK J. OLIVER
Industrial Co-ordinator, College of Engineering
University of Detroit

General Chairman of the Toledo Peace Board. Ralph A. Lind, Director of the Cleveland Regional Labor Relations Board

TO PICTURE the Toledo Industrial Peace Board, as one cartoonist did, with labor and industry wearing halos and joining in a hymn of peace, is somewhat misleading. The cartoon I'd draw would show the two groups sitting on opposite sides of a table, each man with one leg behind his chair, ready to bolt, but afraid to do so because of the burly guards at the exits. The guards would be labeled "Public Opinion."

Few industrialists have any love for organized labor. They are distrustful of labor leadership and are quick to cry "racketeer." Hardened labor leaders, on the other hand, whose lives have been one long fight for a bigger share for labor, find it easy to believe that all employers are Simon Legrees. Traditional enemies will unite in a common cause, however, when the safety of both is jeopardized. Toledo sees that labor disputes when carried to the strike stage yield profits to no one. Business and employment suffer jointly through the bad reputation of the community. So Toledo has a peace plan.

Community Responsibility

What made the adoption of this peace plan possible is an aroused sense of community responsibility. It took the newspapers to awaken this feeling and to rally public support for the plan. They were not acting altogether altruistically. After all, newspapers must live on circulation and advertising. They share no love for one another either, but when three metropolitan dailies unite in a single-purpose crusade, the influence they can wield is tremendous.

The key to the Toledo Plan is the power of the press. Every move has been given front-page publicity and has been backed up editorially. If either labor or industry refuses to cooperate or arbitrate, the newspapers will crack down. The implied threat was recently voiced in an editorial in these words: "I doubt if any single person or group of persons cares to take the responsibility of wrecking this plan, short of an adequate trial."

Events That Led Up—

Toledo has been a traditionally low-pay city. Labor is fighting to correct this condition. Yet labor must be curbed to the extent that the source of wages must not be destroyed in the process. Strikes must be avoided. They are costly to all concerned, and the resentment built up on both sides often takes years to subside. Yet nearly all strikes, no matter how serious or how lengthy, are eventually settled around a conference table. Toledo hopes to settle disputes in conference before war is declared.

In the Toledo Plan, labor has not relinquished the right to strike. It has agreed, however, to give the Peace Board a chance before a strike vote is taken. The essence of the plan is to provide means for negotiation and arbitration after conferences between employer and employees have ended in deadlock.

An epidemic of strikes led to the formation of the Peace Board. The Electric Auto-Lite Company strike in the spring of 1934 had been a particularly nasty affair, with much violence and bloodshed. Its settlement involved a 5 per cent wage increase and recognition of the A. F. of L. Committee for collective bargaining.

Almost a year later the United Automobile Workers (A. F. of L. affiliate) called out its members at the Chevrolet transmission plant. It is generally conceded that the immediate cause of the strike was poor handling of the preliminary negotiations on the part of the local management. The fact that no violence occurred was due largely to the sensible way in which subsequent negotiations were conducted by the general management of the company. Edward F. McGrady, Assistant Secretary of Labor, acted as arbitrator in this dispute. Management agreed to a wage increase of 4 cents an hour and set a minimum of 54 cents, also set up a shop grievance committee. The union had asked for a 70-cent minimum wage.

The Strike That Forced Action

The strike that finally focused the attention of the entire community on the need for some sort of permanent arbitration board was that called by the electrical workers employed by the Toledo Edison Company as a result of disagreement over the renewal of a wage contract. Because a power strike threatened to tie up the whole city, three newspaper editors formed a committee and proceeded to line up both sides.

Groundwork for negotiations had thus been laid by the time McGrady again came in from Washington to act as official arbitrator for the De-

partment of Labor, since the Regional Labor Board lacked authority after NRA was declared unconstitutional. It was during the course of these negotiations that McGrady announced the Toledo Plan. He gave full credit for his inspiration to these three men: Carlton K. Matson, editor, *The Toledo News-Bee;* Grove Patterson, editor, *The Toledo Blade;* and Richard Patterson, editor, *The Toledo Times.*

They came to his assistance when the Edison situation looked darkest. They gave him front-page space for a signed editorial calling upon the community to unite behind the plan. He claimed that employers were not handling the demands of the workers diplomatically. There was no plan or system for taking care of wage disputes before they became serious. McGrady suggested that a meeting be called of representatives of labor, industry, city government, and the newspaper publishers, and that a panel be selected with equal representation of labor and industry. He suggested a name: "The Toledo Plan for Industrial Peace."

The next step was to line up public opinion. Editorials hammered away. Secretary Perkins publicly endorsed her assistant's idea. President Roosevelt approved it and sanctioned McGrady's indefinite stay in Toledo. Hugh S. Johnson endorsed it as having an advantage over the defunct NRA labor boards in that:

1. It is not a tribunal before which one is hailed as a defendant.
2. It is a local institution, familiar with local needs and local conditions.
3. It is a spontaneous, voluntary set-up, not subject to the will of a higher authority.
4. It is fair—based on the interests of every element in the community in the maintenance of industrial peace.

Ten days after the preliminary announcement of the plan, McGrady met with ten leaders of labor and industry. The Chamber of Commerce had been asked to pick the five industrialists, and the officers of the Central Labor Union chose the labor panel. Significant is the fact that the Merchant and Manufacturers' Association, said to be an anti-union employer group, was not asked to participate. While the C.L.U. did not represent labor as a whole in Toledo, being largely composed of the building trades, it is the most widely recognized labor group and contains men with years of experience in labor disputes. The younger hotheads on the labor side were also ignored. At this meeting both groups pledged their best efforts to work out a plan.

At the conclusion of a second meeting held on July 16, the Toledo Plan was formally announced. Ralph A. Lind was named general chairman for a period of three months.* Lind was picked by McGrady as being an outstanding labor mediator. Miss Perkins O.K'd the selection. As Director of the Cleveland Regional Labor Board, Lind had handled nearly fifty strike situations in nothern Ohio in the past year. Lind is not a "labor" man. He has been a real estate operator for some years. He is a straight-from-the-shoulder talker who can see both sides of a dispute. He earned his chevrons in Toledo in helping settle the Auto-Lite strike in conjunction with a fellow Ohioan, Charles A. Taft.

At this organization meeting, Lind

(Continued on page 416)

*The Toledo Peace Board has since been voted a permanent organization with a permanent office and a secretary, paid by the government, to handle details and preliminary labor dispute arrangements.

Digest of the Toledo Plan

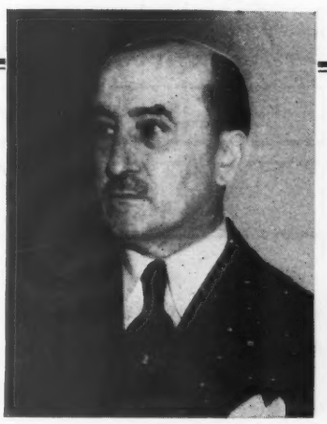
1. Ralph A. Lind is general chairman.

2. Panel consists of five members representing industry, five labor, and eight impartial selected by Lind.

3. Each group of nine has a chairman and vice-chairman, each member serving a month in each capacity in rotation.

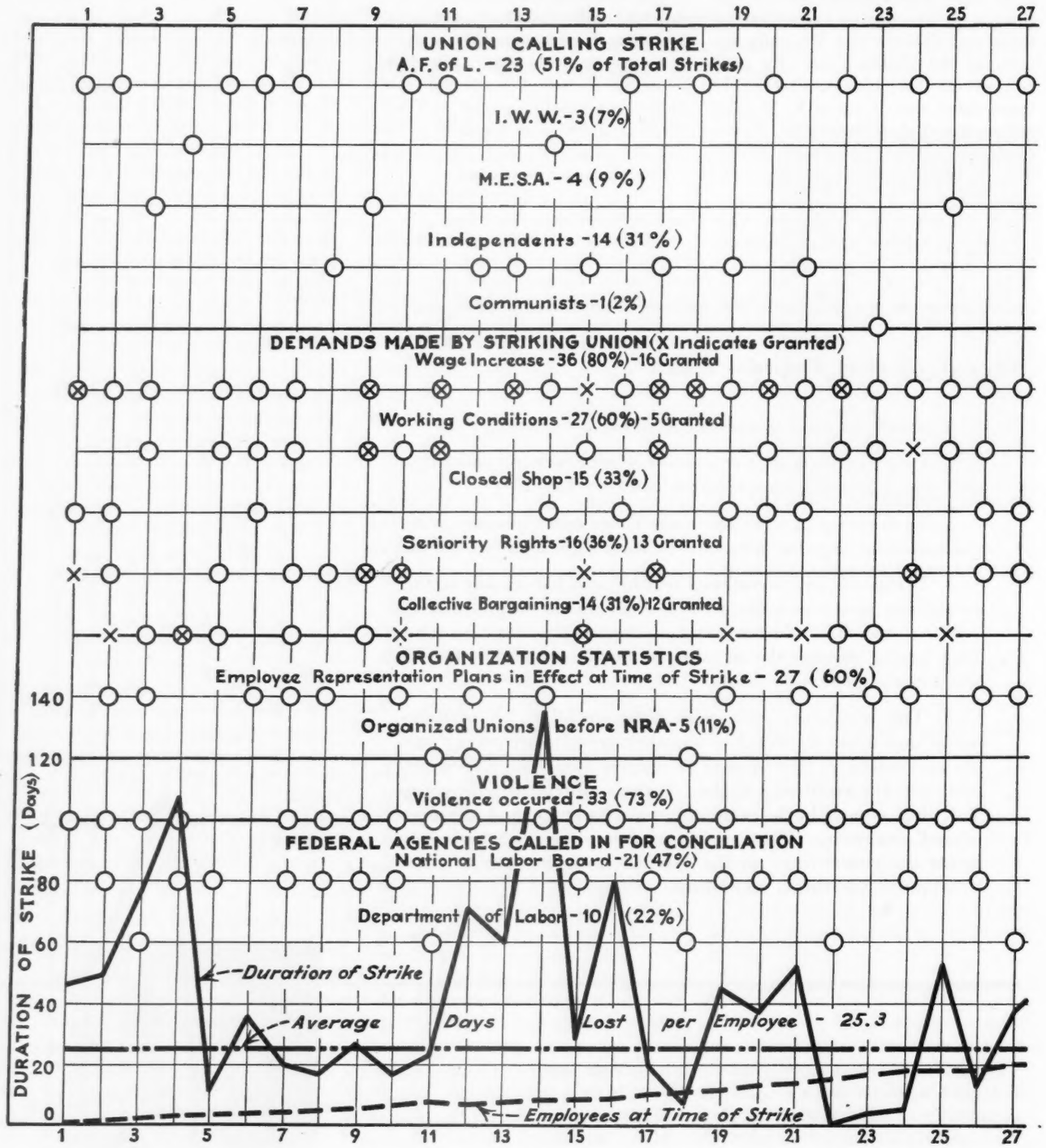
4. If there is any threatened trouble and before any strike or lockout may occur, the general chairman is empowered to call the chairmen of both panels to discuss the situation, and each group chooses the number of mediators designated by the general chairman.

5. The mediators meet with representatives of management and labor involved in the threatened controversy and do everything in their power to suggest some fair and equitable way for avoiding a strike. If their efforts are unsuccessful, they report back to the general chairman and the divisional chairman. That group of three decides whether to refer the controversy to the general committee or whether to appoint additional mediators.



Sponsor of the Toledo Plan. Edward F. McGrady, Assistant Secretary, U. S. Department of Labor

45 Industrial Strikes—

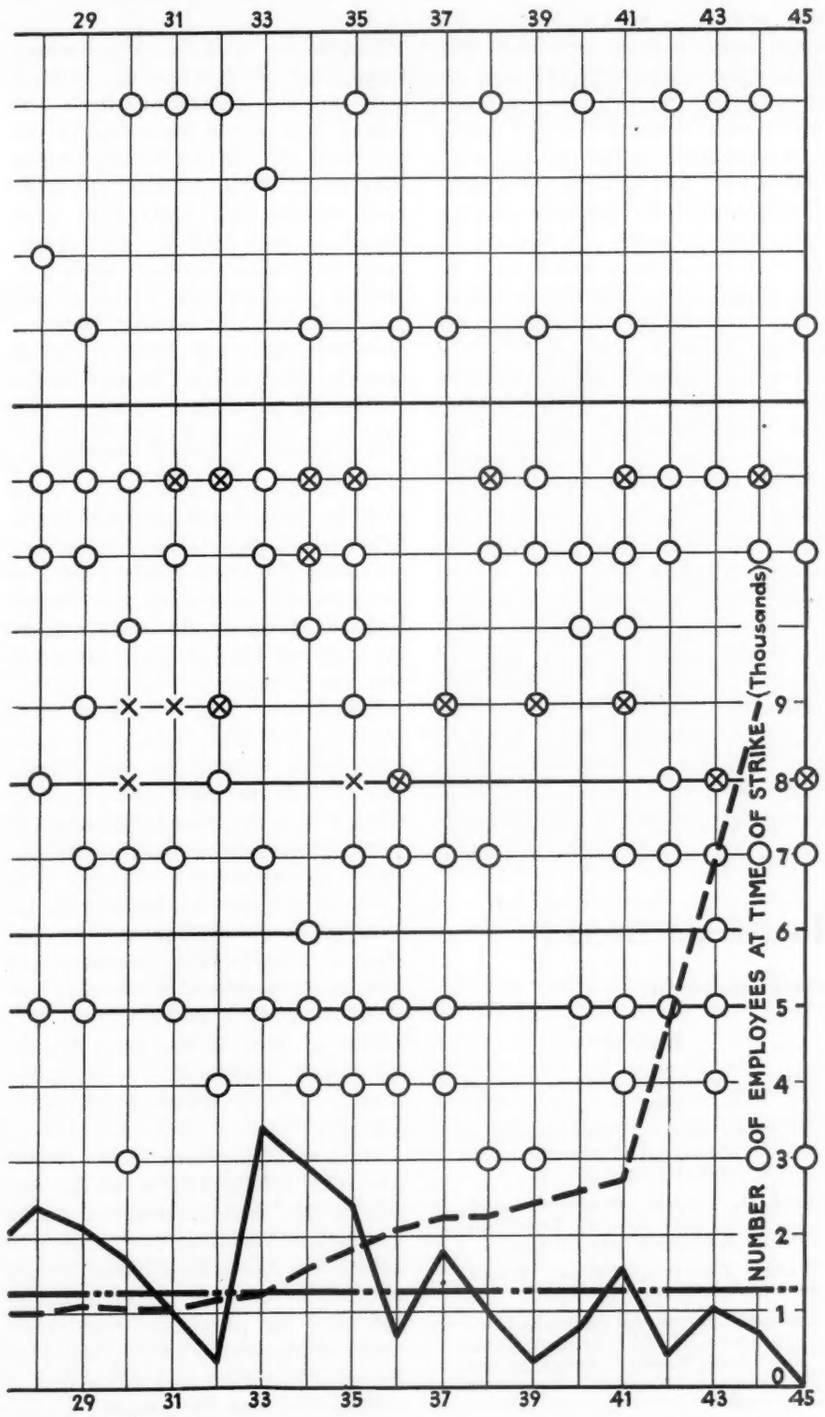

UNION CALLING STRIKE
A. F. of L. - 23 (51% of Total Strikes)
I. W. W. - 3 (7%)
M. E. S. A. - 4 (9%)
Independents - 14 (31%)
Communists - 1 (2%)
DEMANDS MADE BY STRIKING UNION (X Indicates Granted)
Wage Increase - 36 (80%) - 16 Granted
Working Conditions - 27 (60%) - 5 Granted
Closed Shop - 15 (33%)
Seniority Rights - 16 (36%) 13 Granted
Collective Bargaining - 14 (31%) 12 Granted
ORGANIZATION STATISTICS
Employee Representation Plans in Effect at Time of Strike - 27 (60%)
Organized Unions before NRA - 5 (11%)
VIOLENCE
Violence occured - 33 (73%)
FEDERAL AGENCIES CALLED IN FOR CONCILIATION
National Labor Board - 21 (47%)
Department of Labor - 10 (22%)
DURATION OF STRIKE (Days)
Duration of Strike
Average Days Lost per Employee - 25.3
Employees at Time of Strike
1 3 5 7 9 11 13 15 17 19 21 23 25 27
0 20 40 60 80 120 140

Company Key Numbers

(Companies located in Cleveland unless otherwise specified)

1. Frank Luce & Son (Ashtabula)
2. Cleveland File Company
3. Steel & Tubes, Incorporated (Elyria)
4. Draper Manufacturing Company
5. Dover Manufacturing Company (Dover)
6. Davis Laundry & Cleaning Company
7. Ohio Electric & Manufacturing Company
8. Greer Manufacturing Company (Dover)
9. Truscon Steel Company
10. Ashtabula Bow Socket Company (Ashtabula)
11. Van Drivers
12. Breweries (Sandusky, Cleveland)
13. Cleveland Chain & Manufacturing Company
14. Cleveland Wire Spring Company
15. Aetna Rubber Company (Ashtabula)
16. Columbus Packing Company (Columbus)
17. Bender Body Company
18. Toledo Edison Company (Toledo)
19. L. N. Gross Company (Cleveland, Kent)

Why Called, What Happened



Purpose of Chart

Based on detailed historical data published in the *Cleveland Plain Dealer*, this chart has been compiled:

1. To show graphically the history of each of 45 strikes in Northern Ohio.
2. To show basic strike trends.

Symbols

Circles indicate the strike experience of each company affected. In the section dealing with demands, a cross in a circle denotes that the demand was granted; a cross only, that the employer made a concession unasked.

Graphs

Gradual sloping curve shows number of employees in thousands.

Sawtooth curve indicates duration of each strike in days.

Straight line shows average time lost per employee to be 25.3 working days.

Observations

1. Strikes involving largest numbers of employees were generally of shortest duration.
2. A. F. of L. unions called more strikes (51 per cent of the total) than all other groups.
3. Wages were uppermost in workers' minds. Increases were asked for in 80 per cent of the strikes, were granted in 44 per cent of those that included such demands, in 35 per cent of all the strikes.
4. Better working conditions (time and a half for overtime, vacations with pay, check-off systems, etc.) were demanded in 60 per cent of the strikes.
5. None of the 15 demands for closed shop was granted.
6. Thirteen out of 16 demands for seniority rights were granted.
7. Collective bargaining figured as an issue in 14 strikes. Employers made concessions in 5 such instances. Collective bargaining arrangements were set up in 7 others.
8. Of the 23 A. F. of L. unions that called strikes, only 5 unions antedated NRA by two or more years.
9. Violence occurred in 73 per cent of the 45 strikes analyzed.

20. Milk Wagon Drivers (Akron)
21. Kaynee Company (Cleveland, Bucyrus)
22. Union Workers (Hardin County)
23. Chase Brass & Copper Company
24. Willard Storage Battery Company
25. Electric Vacuum Cleaner Company
26. Ohio Rubber Company (Willoughby)
27. Addressograph-Multigraph Company
28. Tool and Die Workers—44 Shops
29. Industrial Rayon Corporation
30. National Carbon Company
31. General Tire Company (Akron)
32. Greer Stell & Reeves Manufacturing Company (Dover)
33. National Screw & Manufacturing Company
34. Clay Workers (Eastern Ohio)
35. Electric Auto-lite (Toledo)
36. Great Atlantic & Pacific Tea Company
37. Cleveland Worsted Mills Company
38. Chevrolet Motor Company (Toledo)
39. White Motor Company
40. Bakery Employees—21 Plants
41. Gasoline Station Operators
42. Berger Manufacturing Company (Canton)
43. Weirton Steel Company (Steubenville, Weirton)
44. Fisher Body Company
45. Threatened Rubber Strike (Akron)

(Continued from page 413)

was empowered to augment the panel by eight impartial members selected by himself. Every effort was made to secure public-spirited citizens. Their names were announced ten days later. At this writing, the complete panel has not met as a group.

Condemned by Mr. Green

Hardly had the plan been announced when William Green condemned it on two counts:

1. The board is too large and unwieldy. Its functioning would involve needless delay in effecting a settlement.

2. The opening of membership on the panel to other than organized labor would make possible a situation unfavorable to A. F. of L. affiliates.

He felt that company union representatives (there is none on the Peace Board now) would vote with their employers. Editor Matson of the *News-Bee* wired Green an open letter, asking him to give the plan a chance. Green thereupon agreed that it should be given a "fair trial."

The original plan formulated by McGrady provided that in a dispute the general chairman should call the chairman of each panel and select a group of mediators. The way it has worked out so far, however, is that Lind has used the board more for moral support than for direct aid. He has used certain members as go-betweens, letting their cooler heads enter a controversy where the immediate principals in the dispute were "seeing red" and spoiling for a fight.

Immediately he assumed charge, Lind went to work. A threatened strike in the cleaning and dyeing industry, involving 1,500 people and 24 concerns, had been smoldering for weeks. Through pressure from the newspapers, the union leaders had been persuaded to withhold action until the new Peace Board was organized. Lind got the employers together and also consulted with the union before the two parties faced each other. With the NRA Code suspended, a price war was in full swing, with 39 cents the price for cleaning a three-piece suit and labor taking the short end in low wages—down to $8 a week in one shop. The settlement resulted in substantial wage increases all along the line, fixed by class of work, and a fixed scale of prices. It costs $1 now to have a suit cleaned in Toledo—or 90 cents cash-and-carry. Cries of price-fixing and violation of the state anti-trust laws were shushed by the press.

Meanwhile, a strike was already under way in a cafeteria. Affairs had reached a point where the woman who owned the cafeteria and the head of the waitresses' union were ready to pull each other's hair. Lind stepped in. Four days later the strike was settled. The agreement involved a restatement of paragraph 7(a) of the NIRA, and provided for the reinstatement of certain strikers and the handling of lay-offs and rehiring. It prevented a threatened pay cut.

Fair, and Without Fireworks

On the heels of this strike, word came to Lind that trouble was brewing at the Textileather Corporation, involving 400 employees. Basically, the bone of contention was wages. They were below the standards of the city, but the company claimed it was losing money.

Labor was represented in this plant by a United Textile Workers' local union. Both sides were reasonable in their attitudes, and an agreement was soon reached that involved a "satisfactory" increase in pay and other concessions to labor. The union on its part recognized its responsibility in making the pay increases economically possible, and pledged its workers to increase efficiency wherever feasible. A committee of workers has been formed to report suggestions to management. It is the speed-up idea, self-imposed.

By way of contrast, let us review how the Toledo Edison strike and subsequent negotiations are being handled. This strike got under way before the Peace Board was formed and has never come under its jurisdiction. As previously mentioned, three newspaper editors acted as the initial arbitrators and succeeded in getting the men back to work. McGrady stepped in, granted office workers and operating employees a 5 per cent pay increase (20 per cent had been asked), and also appointed a permanent wage jury of five men, two representing labor, two disinterested non-residents, and one government man. The jury held open hearings in a courtroom, and each

(Continued on advertising page 74)

Members of Toledo Peace Board

Ralph A. Lind, General Chairman

Industry

David H. Goodwillie, Executive Vice-President, Libbey-Owens-Ford Glass Company

Harry C. Tillotson, President, Tillotson Manufacturing Company

Earl S. Smith, President and Treasurer, Toledo Porcelain Enamel Products Company

Frank H. Adams, Vice-President and General Manager, Surface Combustion Company

Royce G. Martin, Vice-President, Electric Auto-Lite Company

Labor

Otto W. Brach, Secretary, Central Labor Union

Oliver E. Meyers, Business Agent, International Brotherhood of Electrical Workers

Fred H. Watson, Business Agent, Carpenters Union; Vice-President, Central Labor Union

Walter Guntrup, Editor, *Toledo Union Leader*

Lawrence J. Aubry, Chairman, Committee of 23, Central Labor Union; Business Agent, Motion Picture Machine Operators' Union

Impartial

Judge Chas. F. Chittenden, Probate Court

Rabbi Leon E. Feuer

Judge Robt. G. Gosline, Common Pleas Court

John W. Hackett, Attorney

Milo J. Warner, Attorney

Clarence A. Benedict, Country Relief Director

Rev. Mgr. Francis J. Macelwane, Dean of Toledo Teachers' College

Lewis L. Eppstein, President, La Salle & Koch Company (department store); President, Retail Merchants' Board

They Don't Chance Quality

Not these five! They know quality has a lot to do with how much they sell, so have set up controls that insure product uniformity

CORTLAND G. SMITH
Assistant Editor

FEW, IF ANY, are the plants that can afford to take a chance on quality. Quality must be right; not too high, not too low. There are many ways of controlling it. Here are five different ways from as many industries:

Conveyorized inspection of laminated safety glass at the Rouge Plant of Ford Motor Company, Dearborn, Michigan

I

Paper Boxes. One company within the past two years has had a very gratifying success with the plan of centralizing all product research and quality control in one organization. The head of this department is a Ph.D., a trained and experienced research man. He and his assistants are ready to deal with any quality problem referred to them by the operating organization, and in addition undertake on their own initiative studies for the improvement of processes, chemical treatments, better or more economical raw materials, and so on. Routine inspection is handled by the operating departments; this includes checking for dimensions, elimination of misprinted or otherwise defective boxes, and the like.

Each day the standards department picks at random a definite number of boxes and submits each test to destruction, to make sure that it is above the minimum guaranteed load-carrying capacity. The tests cover conformity of the paper stock to required specifications for strength and stiffness and permeability to moisture, and the like. The training and background of most of the men in this standards department is technical and laboratory. The company reports a marked advantage in competition, and a reduction in cost with increase of quality, as a result of the development.

II

Hosiery. This manufacturer has adopted an organization very similar in general outline to that described. As the finished hosiery is given its final pressing on a steam-heated form, an opportunity is afforded for the detection of flaws that would cause the classification of the garment as a second; the operations of pressing and final inspection are therefore combined. The girls who pack the hosiery in boxes are also on the watch for mismated sizes, colors, and other defects, and for correspondence with the description called for by the label.

As in Case I, a separate standards department is in charge both of product development and process improvement research (acting in cooperation with the operating foremen) and of spot checks at frequent intervals of the work of every operator in the plant. These checks cover not only defective workmanship, but also defects caused by worn or improperly adjusted machines, material troubles, or other causes. A considerable part of the attention of the department is devoted to analyzing the causes and finding a remedy for the various difficulties that may arise in handling a material as delicate and sensitive as knitted silk.

The head of the inspection department received his training in the factory as an inspector, but was selected for his ingenuity in dealing with new situations as well as his inspection experience. The head of the research laboratory is a research-trained Ph.D. The company reports a marked advantage in cost and in quality and reduction of seconds, as a result of centralizing the work of quality control and putting it in the hands of specialists in place of the previous practice of holding foremen responsible.

III

Metal Furniture. The product is of medium quality, the emphasis in most lines being on price. A full-time inspector passes on all completed work before it is packed, sending defective pieces back for re-

(Continued on advertising page 58)

For Once-in-a-While Jobs, Too

Not just "big-time stuff," motion study works equally well on jobs where activity is low or size limits what you may spend for fixtures

G. W. WEHRLE
Time-Study Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh

ALTHOUGH it is generally conceded that motion analysis is profitable on jobs of large activity, the impression seems to prevail in some quarters that it has no value on jobs of low activity, or where quantities are small enough to prohibit large expenditures for tools or automatic equipment. Motion analysis is nothing more than a common-sense analysis of the elements of the job for the purpose of eliminating wasted effort and determining the one best and most economical way to do the job. *A good enough way to do the job is not sufficient today.* There is a best way to do every job, and that way must be found.

Very often we are confronted with the problem of reducing the manufacturing cost on some given piece of apparatus. From analysis of conditions we find that rates of pay must be maintained and standards of quality held or raised. We also find that material costs are in line with other apparatus and that the design is of the improved type. What can be done to reduce the cost without lowering wages or quality?

Such a problem confronted us on mechanisms for network switches. This apparatus is highly competitive. Through analysis we found the design satisfactory. Material costs were at market level. Our detail analysis, therefore, had to center around labor costs. How could they be reduced without large expenditures for tools and without disturbing the earning power of the operators?

Motion Study Shows How

Our analysis had left only labor to work with, so we resorted to motion analysis. Each machining operation was reviewed with the purpose of changing methods, both as to machines and sequence, but it was found that little improvement could be made. However, the assembly showed promise of possible changes. Two sub-assemblies were difficult because of the shape and nature of the parts. The main assembly also required considerable time because many parts had to be assembled in the frame with a minimum amount of friction.

Instead of a Common Vise

The existing set-up provided no assembly fixtures and no particular arrangement for material or parts. All assemblies, including the final one, were performed in a common vise. Materials were provided in tote pans from which they were transferred to the bench, as near as possible to the job, but with no special arrangement in mind to avoid unnecessary movements of the arms or body—a condition usually encountered when making a motion analysis of a job of small activity.

A simple, inexpensive fixture was made for the assembly of the trunnion (see Figure 1) on which the part could be turned 360 degrees and tightened with the aid of a quick-acting cam, leaving the operator the use of both hands for assembly purposes. The fixture was supplemented by a small circular bin, divided into compartments to hold

Figure 1. Motion-economized layout for assembly of network switches. The common vises formerly used have been replaced by inexpensive fixtures (right) for trunnion assembly and (left) for trunnion and fly-ball assembly. Circular bin holds materials and parts within easy reach

material and hardware, which the operator could reach without any movement of the body. Needless to say, the labor on this assembly was reduced.

A somewhat similar fixture was made to complete the trunnion and fly-ball assembly. This fixture really answers the purpose of two complete fixtures in that the trunnion, the shaft, and other details are assembled on one part of the fixture and a cam-shaped groove is provided on an upright at the opposite side for the assembly of the links, the bearing, and necessary hardware to the shaft. The shaft, cam-shaped on one end, fits snugly into the grooved upright, allowing for ease of assembly and use of both hands.

An Inexpensive Fixture

This fixture, like the other one mentioned, is so placed as to allow the use of the same circular material bin used in the assembly of the trunnion. Like the other fixture, this one is inexpensive. Practically the same savings were realized.

The main assembly arrangement consists of a swivel fixture (Figure 2) that can be tilted to an angle of 45 degrees, giving access to the frame from all sides and allowing adjustments to be made at the desired angle. This fixture eliminates all stretching to the sides and rear of the frame for link and rod end assemblies. It also eliminates constant handling of the heavy frame to secure a vantage point for the assembly of some part. With a slight twist of the hand, the fixture revolves to the desired point, even when loaded.

This fixture also is supplemented by a circular bin of large proportions containing all the assembly parts and hardware necessary to complete the job. Although the bin is rather large, the workman can reach to either or both extremes at the same time without any movement of the body.

Saved 40 Per Cent in Labor

Thus a mean and awkward assembly was transformed into a comparatively simple and compact one—nothing spectacular, but good business when it is considered that rates of pay and hourly earnings were maintained, quality was unimpaired, design was not changed, material prices remained the same, yet a saving of 40 per cent in labor was effected, or enough to cover the tool expenditure in less than one month even at the present low activity.

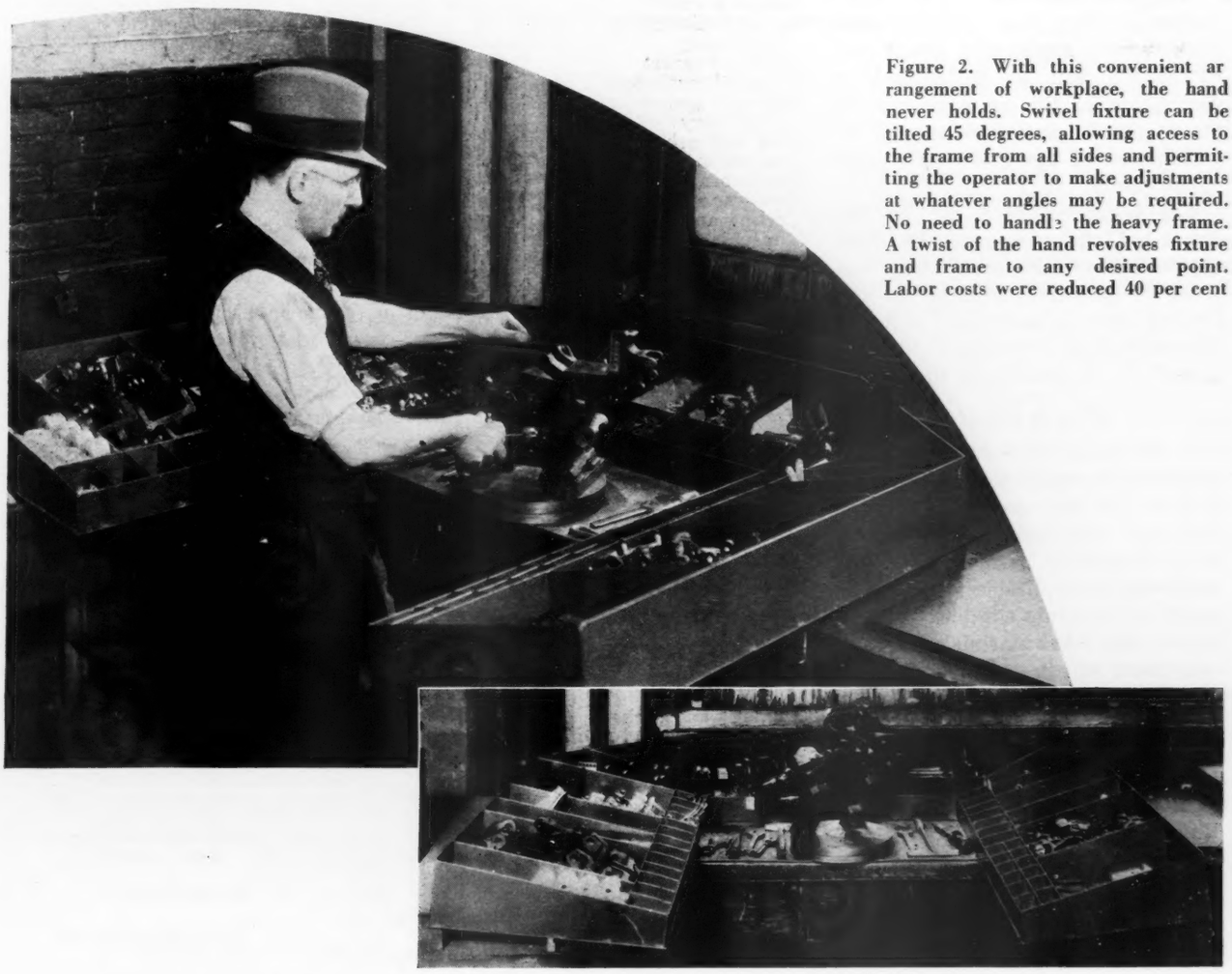


Figure 2. With this convenient arrangement of workplace, the hand never holds. Swivel fixture can be tilted 45 degrees, allowing access to the frame from all sides and permitting the operator to make adjustments at whatever angles may be required. No need to handle the heavy frame. A twist of the hand revolves fixture and frame to any desired point. Labor costs were reduced 40 per cent

FHA Equipment Loans

Industrial modernization loans (Class A) insured by FHA since the limit was raised to $50,000, number 514 or a grand total of $2,718,245 up to September 14

TO GUIDE potential borrowers of modernization money and approved financial institutions making such loans with the intention of having them insured by the Federal Housing Administration, a list of "eligible equipment and machinery" has been prepared.

A qualified borrower of these loans is defined as "any individual, partnership, corporation, or association who makes application for a loan upon a form approved by the FHA, and whose application is approved by a financial institution operating under a Contract of Insurance issued by the Administrator." The credit statement filed must contain data from which applicant's credit responsibility can be determined, a description of the property and of the proposed improvements, and an explanation of the applicant's right of occupancy.

The borrower need not be the owner of the property. He may obtain loans for more than one piece of property, and up to the $50,000 limit in each case, provided that each piece for which application is made is separate from the others.

What Is Eligible

In general, all production and most maintenance equipment is eligible. If it can be fastened down or is in any way permanently attached, if it is of durable nature, and if its unit value is applicable to time payments, it is surely eligible. Trucks, cranes, and other materials handling equipment will be approved, if they are intended as permanent installations and not as temporary construction tools.

What is more, the list shown here is not in any sense complete. It continues to grow as FHA passes on individual applications. If any item not included on the list is wanted, a request should be made to FHA headquarters for a ruling.

Eligible Equipment for Industrial Plants

Abattoir presses

Bag balers and presses
Bag-filling machinery
Bagging machinery
Bakery machinery
Banding machinery
Barrel-packing machinery
Belt-folding machinery
Belt-lacing machinery
Beveling machinery
Bins
Blast furnaces
Blueing machinery
Body-making machinery
Bolt- and nut-making machinery
Bookbinding machinery
Bottling machinery
Box-making machinery
Brass machinery
Brewery machinery
Brick and tile machinery

Candy machinery
Can-making machinery
Canning machinery
Carbonating machinery
Carpet-cleaning machinery
Carpet looms
Carpet mills sewing machinery
Chain conveyors
Chemical machinery
Cigarette and cigar machinery
Coal and ash conveyors
Coal-washing machinery
Condensers
Cooperage machinery
Cutting and folding machinery
Cylinder-boring machinery

Dairy machinery
Distilling machinery
Dyeing, finishing, and bleaching machinery

Embossing machinery
Engraving machinery
Evaporating machinery
Excelsior machinery

Factory equipment
Fertilizer machinery
Fiber machinery
Forges
Foundry machinery and equipment
Fur machinery

Gas filters and compressors
Gas tanks
Glass-making machinery and equipment
Glove machinery
Graphite machinery
Grinding machinery
Gumming machinery

Hosiery machinery

Ice-cream machinery
Ice and refrigeration machinery
Interior overhead trolleys and conveyors

Japanning equipment
Jewelers' machinery

Labeling machinery
Lamp-making machinery
Lithography machinery
Loading chutes

Machine tools
Metal-working machinery
Mining machinery
Moistening machinery

Nail-cutting machinery

Oil-well machinery (not portable drills)

Packaging machinery
Paper-box and bag machinery
Paper-cutting machinery
Paper-making machinery
Pattern machinery
Pharmaceutical machinery
Photo-engraving machinery
Planing machinery
Plating machinery
Polishing machinery
Porcelain-manufacturing equipment
Pottery machinery
Power drill (not portable)
Power fans and blowers
Power hammers (not portable)
Power punches (not portable)
Printing and binding machinery
Printing and developing machinery
Pulp- and paper-making machinery

Rolling-mill machinery
Rubber-working machinery

Salt-making machinery
Separator machinery
Shoe machinery
Silk machinery
Slate machinery
Slaughter-house equipment
Soap machinery
Spring- and wire-coiling machinery
Stoneware machinery

Textile machinery
Twisting machinery

Welding machine and equipment (not portable)
Wire-making machinery
Wood lathes
Wood-working machinery
Wool-washing machinery

Eligible Equipment for Any "Class A" Structure

Air conditioning
Automatic stokers

Blinds
Boilers
Burglar alarm systems

Cellar grates
Cellar pumps
Cellar traps
Cisterns and tanks
Compressors

Drainage control systems
Drains
Dumb-waiters
Dynamos

Electric clock installations
Electric light and gas fixtures
Elevators
Engines
Escalators

Feed and water heaters
Feeders
Filters
Fire alarm systems
Fire control equipment
Firedoors and fittings
Fire escapes
Flooring
Furnaces

Gate valves
Generators

Heating systems
Hoists

Interior telephones

Lavatory equipment

Plate glass
Plumbing fixtures
Pneumatic communication systems
Pneumatic tubes
Power plant equipment
Pumps

Revolving doors
Roofing

Sprinkler systems
Structural steel (when used for repairs, alterations, or improvements)
Switchboard installations (electric)

Tower clocks

Ventilating systems
Ventilators

Center aisle used to be 4 feet wide, was always cluttered up with skid platforms and boxes waiting for someone to move them from station to station. Now it's 12 feet and never congested. Rubber-tired trucks expedite the picking of stock. Station system has been abandoned

What Happened to Stockroom 83

A storage problem surveyed, newest steel equipment installed, stock moved, methods changed — without interrupting production

LEWIS K. URQUHART
Associate Editor

WHEN a stockroom whose sole function is service to production is no longer able to give the service to which production is entitled and accustomed, it would seem to be time for an accounting.

That is approximately what happened fifteen months ago at International Business Machines Corporation, Endicott, N. Y. Production Stockroom No. 83 was not operating satisfactorily.

An initial survey revealed the following causes:

1. Main aisle cluttered up with skid platforms and boxes due to station system where one man was responsible for picking certain items and then passed on the order to another station.

2. Narrow cross aisles made it impossible for two men to pass each other without interference.

3. No positive method of marking stock. Stock carried in cake pans of three sizes. No label holder. Only a linen tag attached to pan handle.

4. Stock location no closer than in a space 6 feet long, and in any one of 50 or more pans on a shelf.

5. Method of picking stock was to go to shelf, find stock, remove pan to counting scale, weigh out required quantity, and return pan.

6. Much delay in putting incoming stock away and getting record of receipts back to record clerk.

7. Larger containers than necessary for small parts, with resulting loss of storage space.

8. No mobile handling system. Order placed on skid platform and moved by slow stages the length of stockroom, someone looking for a lift truck each time a move was necessary.

9. No attempt at unit packaging. Even when materials came packaged from suppliers, the packages were broken open and the parts stored loose.

Saw Definite Saving in Labor

This preliminary survey provided enough data to convince the management that a marked improvement in handling and a definite saving in direct labor could be effected by the installation of Lyon adjustable steel equipment.

To determine exact requirements, physical checks were then made of the displacement of racks and bulk containers, and of the actual cubic displacement of stock stored in them. With these data in hand, it was calculated that the 27,000 items of stock could be stored in less floor space and in equipment displacing less than 60 per cent of the space occupied by the old.

Actual layout of the room now became a detail rather than a problem. Floor space was actually reduced by about 2,000 square feet; average size of bin and box spaces, by about one-third.

The old 4-ft. center aisle was widened to 12 feet. Cross aisles were changed to 32 inches. All traffic was made one-way. Small light trucks were designed to permit easier, faster handling of stock. And, perhaps most important, a definite numbering system was set up to provide for location of any

Stock was formerly kept in cake pans. Compare this adjustable steel equipment. Numbering system enables stockpickers to locate within 6 inches any one of 27,000 items

item by bin number within a range of 6 inches.

Not the smallest part of the problem was the change in methods, the erection of the new equipment, and the moving of the stock. This task was complicated by the fact that the new shelving had to be placed in the space already occupied by the old—and, of course, the stockroom had to keep right on operating during the move.

Moving Looked Formidable, Wasn't

The matter of installing the new equipment was covered by moving out a certain number of racks to give room to start erection, then to move the stock from the old to the new racks, and repeat. It worked well. The equipment manufacturers promised to complete erection in 21 days from date of receipt of the first carload of material, actually finished in 22 days.

Moving the stock looked like a more formidable problem than it actually turned out to be. The method followed had for its fundamental basis the placing of the stock in the proper container, the marking of this container, and the recording of the location. The only time the stock was ever out of actual control was while in transit from old to new racks—never more than half an hour.

A tabulating card formed the bin tag necessary for the marking and locating of the stock. The stub of the card became the actual location card.

The stockpicking method now followed is to have requisitions come to the stockroom for individual items, with only part number and location appearing on the orders. In other words, the station system has been discarded.

One point not to be overlooked is that, in order to conserve room in the bins, as well as to reduce the cost of picking stock, the setting up of several sizes of units and the packaging of parts into these units was planned, thus doing away with the need of weighing every item out. The material must, of course, be weighed in, but with proper equipment the packaging costs far less than the labor under the old method of picking stock. Equally important, the packaging greatly speeds up the handling of stockroom orders.

This packaging plan is gradually being adopted, and will as time goes on continue to reduce handling time.

Every Item Easy to Find

The new numbering system plays no small part, of course, in the successful operation of the new room. First, all sections are numbered, beginning at the front of the room; large, easily read targets show section numbers.

Second, shelf levels are numbered from the top down, the method followed being such that if shelves are added at any time the numbers can be interpolated without renumbering any of the old shelves. Examination of the accompanying close-up photograph will make this point clear.

Under the old system, then, there was congestion, lost time, higher stockroom costs than necessary—all because of the poor layout and the difficulty of locating the pan that contained the part wanted. The new stockroom has wider aisles; handy trucks expedite the stockpicking operation; packaging, where it can be used, eliminates useless weighing or counting; and a simple numbering system definitely and positively locates each and every item of stock.

No Shortcuts to Safety

W. H. CAMERON
Managing Director
National Safety Council

THE PROBLEM of preventing industrial accidents is not so much devising methods and tools which, if properly used, will avoid accidents, but rather one of getting the workers generally to use, properly and consistently, the safe methods and tools we now have.

Prevention of accidents, like prevention of waste material and time, is largely a matter of forming habits of careful workmanship.

The same slip of the screwdriver that punctures the hand also mars the screw, damages some other part of the equipment, wastes time, and indicates faulty or incomplete training.

From the workman's point of view, it is easier to use a screwdriver correctly. Then why are the careless methods still in vogue? Simply because workmen at the outset learned wrong habits and were permitted to use them for years and years. . . . The key to efficient and safe workmanship is the continuous repetition, over and over, true to form, of correctly planned methods of work. There are no shortcuts.

From an address made at the Eighteenth Annual Conference on Industrial Relations, Silver Bay on Lake George, N. Y.

Government, Employers, Employees

An analysis of New Deal laws and proposed laws to answer the question: What are the trends of government influence in employer-employee relations?

L. C. MORROW
Editor

FIRST major legislative step bearing particularly upon labor, and therefore upon employer-employee relations, was the Black 30-hour bill. It passed the Senate, was sidetracked for the NIRA, was re-introduced in the last Congress.

Even as a trial horse, the 30-hour bill was an important document. It served to inform both labor and industry that there existed in the new Congress an unusually receptive attitude toward labor legislation. It also gave the first indication of a willingness to translate into action the theory that the country has reached a condition now known as an economy of plenty as contrasted with an economy of scarcity.

This theory held that we were overproduced, that wealth had accumulated in the hands of a few, and that a more widespread distribution of existing wealth, by means of legislative fiat, was essential to recovery. It took no account of the fact that the only wealth we can have is what we produce as usable goods, and that even in our most prosperous years the wealth we had, as measured by standard of living, fell far short of what we should be able to achieve.

The present 30-hour bill disregards the inability of industry to pay the increase, and overlooks the rising prices, reduced sales, and increased unemployment that would result.

Pleasantly Palatable Theory

The Black Bill raised the hopes of labor unjustifiably and stimulated the growth of a pleasantly palatable, but indigestible economic theory. The net result has been to retard recovery and to cause labor to seek to pluck fruit from the social tree before it is ripe.

Paragraph 7(a) of the National Industrial Recovery Act was the next major piece of labor legislation. This short paragraph looked to organized labor like a green light for full speed ahead. To employers it looked like a clear signal for so-called company unions, more impartially known as employee representation organizations. Because of the conflict of these two viewpoints, interpretations of 7(a) were called for, and many were forthcoming. Among them were two of principal import, both emanating from responsible sources. One called for "majority" representation, the other for "proportional" representation. Ensuing squabbles resulted in the creation of the National Labor Board which ruled in favor of majority representation, a clear victory for organized labor.

¶ THIS INDUSTRIAL nation of ours must make in order to have. What it makes must be produced at the lowest possible cost in order that the greatest number of people can share. To make its products at low cost industry must take full advantage of technological developments in methods and equipment. In this procedure industry must not fail to deal fairly with its workers and its stockholders

The NIRA did something for unorganized labor, also, in that its paragraph 7(a) was directly responsible for the increase of employee representation plans, and for the revision of many of those already in existence to insure employees a voice in the determination of hours and wages. In the light of recent legislation this result evidently was not intended and, for the time being, this advantage to unorganized labor seems to be neutralized.

Another boon to unorganized labor was the establishment of minimum wage rates and maximum hours. Regardless of the longtime economics of thus limiting the flexibility of our industrial structure—and there are serious thinkers who believe that no limits should be set—there ensued at the time a needed stabilization of the wage structure to put a limit on the proportion of the depression burden that workers had to bear.

Real Wage Not Increased

There is a doubt, however, that labor as a whole was more than temporarily benefited by the NIRA. Costs of products were increased, prices rose, and industrial labor was forced to contribute to agricultural labor by means of the AAA. With these added drains, it is questionable that the real wage of the industrial worker was increased.

With the passing of the NIRA via the Supreme Court, the National Labor Relations Act, dormant since its introduction a year before, was brought to the front and passed. In my opinion the act *is* a green light for organized labor. It sanctions the closed shop. It discourages the non-union forms of employee representation. It does not give free choice of representatives to each worker. It so circumscribes the employer by definitions of unfair practice that he will perforce walk circumspectly the while his workers are being organized. For the activities of the organizing agencies there are no legal restrictions. These agencies cannot be held responsible financially. They cannot be compelled to live up to agreements, except by the force of public opinion.

By the Labor Relations Act,

Abstract of paper presented at the Eighteenth Annual Conference on Industrial Relations, Silver Bay, N. Y., August 28, 1935.

strikers are still employees. They have their employee votes. This is a distinct gain for organized labor. Irrespective of how they were induced to join a union—whether they are shot-gun bridegrooms, or walked willingly to the altar—these employees will vote with the union so long as they are on strike.

Much depends upon the personnel of the National Labor Board. Certainly these men have a job cut out for them. It seems to me that they will face the task of administering a law drawn upon the assumption that workers and employer must be antagonistic. If we are to have amicable industrial relations, these men, while administering that kind of law, must prove that the interests of labor and employer are identical instead of different and opposed.

> **No matter how much we may increase wage rates with a view to expanding purchasing power, we will not find available in the market places the goods which minister to the satisfaction of human wants unless they are produced. Whether we live under a wage, price and profit system, or under a completely communistic method of economic organization, it will always be true that the level of consumption or the standard of living can be raised only through the production of food, clothing, shelter, comforts and luxuries. — *Brookings Institution***

Political Football

In the Social Security Act we have another legislative move that is pointed directly at labor. I cannot see that it will particularly affect the relationship between employee and employer.

However, it is not difficult to conceive of a political situation wherein the contending parties vie with each other in promising increased financial benefits to workers under the Security Act. Likewise, it requires no stretch of the imagination to foresee drives upon the Treasury, from many sources, to divert from security purposes the reserve funds set up by the Act.

Failure to accept the Clark amendment permitting private pension plans, with corresponding credits against the Federal tax, will present a ticklish problem to some employers. Are existing plans to be continued as they are? Or are premiums and therefore benefits to be reduced? Should private plans be super-imposed upon the Federal system because of the inadequacy of the Federal benefits?

We have not yet solved the problems attendant upon the retirement of the human machine. By the Security Act we have forced employees to be less improvident in their own future welfare, but at the same time may have implanted the theory that the state is responsible for the individual in the final analysis. This is now a matter of employer-employee relations, as it always has been. It has been spotlighted by both the depression and social legislation.

The Guffey Bill and the Walsh Bill, both fresh in your minds, indicate the definite intent of the Government to continue the NIRA provisions in spite of the Supreme Court decision, so far as it can.

Federal Coal Control

The Guffey Bill sets up a control commission in the bituminous coal industry. Presumably the labor representatives on the commission, and its 23 sectional subdivisions, will be taken from the present union labor organization, which would not change existing conditions so far as employer-employee relations are concerned. However, the bill sets up Federal control in a large and important industry. Sooner or later there will be detailed regulation of employer-employee relations, and the case will tend to show whether or not similar control should be extended to other industries. Whether or not the bituminous coal industry needs the control proposed I do not presume to say. I merely point out that it is an important step toward nationalization and that nationalization is bound to be accompanied by Federal regulation of details that are now handled as matters of routine, judgment, or exception.

The Walsh Bill would give the President power to establish minimum-wage and maximum-hour standards, plus a 16-year age limit, applying to all contractors dealing with the Government — sub-contractors and all persons furnishing articles, materials, supplies, equipment, and services in connection therewith. These standards would apply not only to direct Government transactions, but also to all operations financed in whole or in part by Federal funds, loans or grants to political subdivisions, private corporations, or individuals. The President would have approximately the powers granted him under NRA, because of the extent to which manufactured products enter into government contracts, and because of loan ramifications.

Danger in Walsh Bill

I do not see how we can help having accusations and recriminations from labor, if this bill is passed, which might result in altercations equal to those under NRA. Its effect upon employer-employee relations would lie in the opportunities it would give for misunderstanding, for confusion in interpretation and application, and in the added complications of work stabilization.

Other legislative proposals are in the offing. Among them are the Textile Control Bill and the Federal Licensing Bill. They are not likely to be given very serious consideration in their present form, but they are worth study because they are sponsored by organized labor and indicate the direction of the thinking being done by that influential group. Probably both of these bills, in modified form, will be the subjects of Congressional action in 1936.

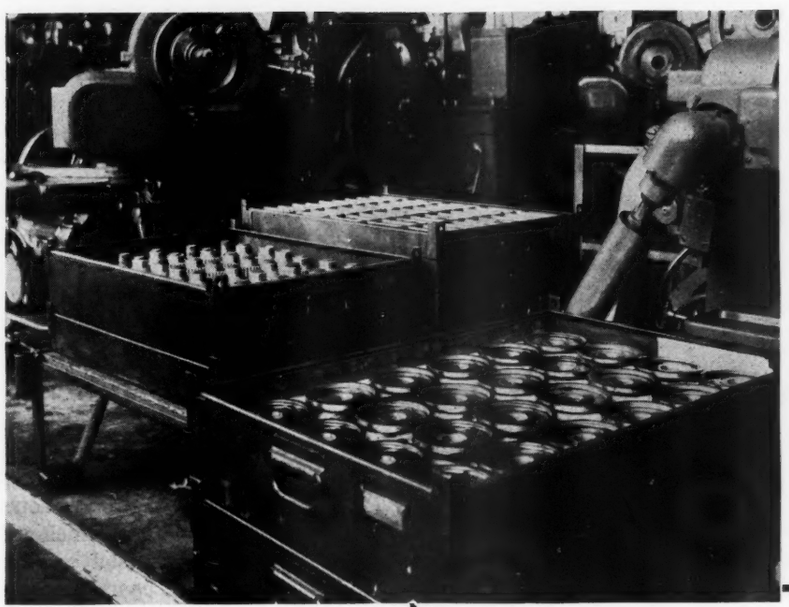
The Textile Control Bill would set

(Continued on advertising page 62)

Tote Box Fits the Part

From standard frames and assorted liners this concern can build hundreds of "tailored" tote boxes that handle with never a nick or scratch

CARL J. WIBERG
Production Engineering Department
Wright Aeronautical Corporation
Paterson, N. J.



These standard steel frames and assorted pine liners make possible a special factory carrier for each part manufactured

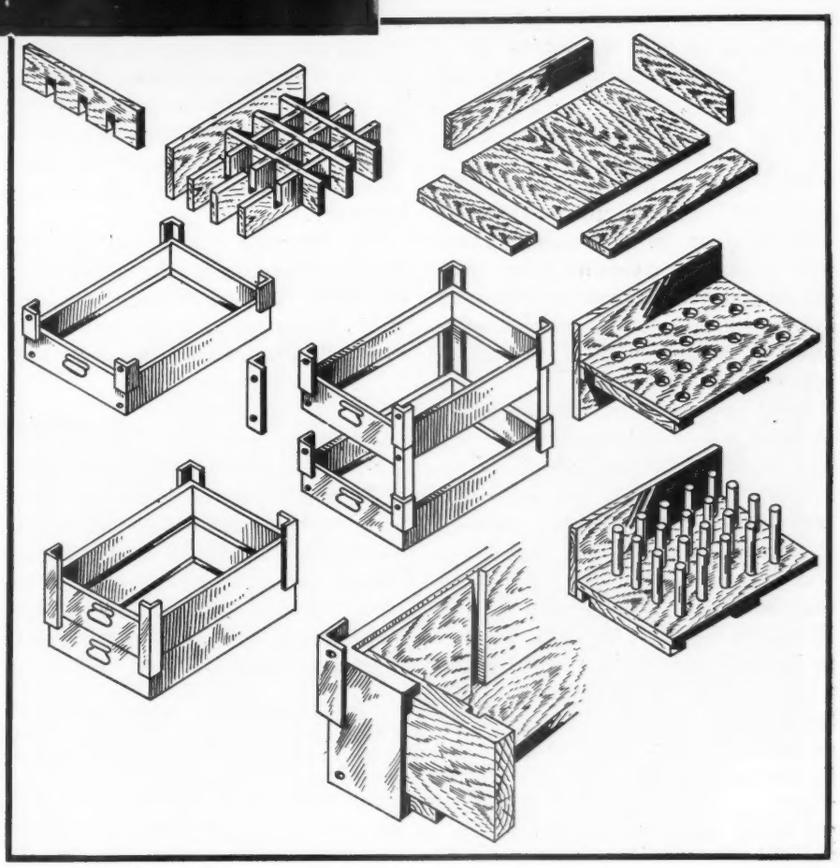
TO PROTECT gears, valves, and other highly finished parts from damage in handling from machine to machine, we had long used containers to keep the parts separated and enable group handling without damage. But the wide variety of shapes and sizes had given rise to a multiplicity of carriers which brought on confusion, expense, and often the use of misfit containers.

About a year and a half ago we decided to standardize on these carrier boxes. A survey was conducted to learn what sizes and shapes were being used and to determine a basis for standardization. A questionnaire was sent to each department foreman. On it were shown in diagram the general types of containers in use, with dimensions left blank. The foremen were requested to list the number of each type of container used in their departments and fill in dimensions.

Standardized carrier boxes were worked out from this information. Contact with metal surfaces had to be avoided, yet metal containers would be much more durable than wood. So we devised a standard frame of sheet metal with a variety of soft pine liners, bottoms, trays, and partitions that could be easily and quickly interchanged.

Partitions, Holes, Pegs

The nature of parts we make calls for three general types of containers—those with partitions, those with holes, those with pegs. These



we call *X*, *Y*, and *Z* carriers respectively. Standard *X* boxes can be made up from stock in 679 different size compartments; *Y* carriers in 71 different sizes of holes and spacings; *Z* in 77 different sizes of pegs and spacings. Any special interiors can also be made up to suit further requirements.

Steel frames are of two sizes only, all dimensions of each size being the same except height, which is 3¾ inches on one and 5¾ inches on the other. Frames are all 30 inches long, 20 inches wide, with a handle at each end and an angle at each top corner for nesting or for making up with angle irons into various combinations of solid or crate to attain a desired depth.

No nails are used. The only screws are those that fasten frame to angle iron or angle iron to angle iron in building up combinations. The size was selected in consideration of weight in handling and also to fit our regular skids, two frames just fitting a skid.

Box and Part Get Together

When the production planning department issues a production order for a part, its size and shape are noted, and the proper carrier box for it is determined. As the order for production is released, an order for carriers also goes out so that the proper carriers in the required number will be ready for the parts when the parts are ready for them. Each carrier has a plate on which there is an identifying symbol, and corresponding information appears on the production order. Thus part and carrier get together. And when the part has finished its run and gone into stock, the carrier is returned to central storage for cleaning and repair if needed, and there awaits the next order. If required, the carriers can be quickly disassembled and reassembled.

We now have about 1,000 of the steel frames and a complete assortment of wooden sections. Maintenance is low. Parts are properly protected so that damage in handling is minimized.

In selecting the proper carrier for a given part most factors will be evident. Less obvious is allowance for gripping the part in order to remove it from the carrier. Clearance between part and partition, hole, or peg must also be figured. We allow at least ¼ inch with partitions and 1/16 inch at the pegs and holes, with not less than ¼ inch at other points in peg and hole carriers.

Skilled Help Scarce; What to Do

ANY SUDDEN need for a rise to normal production capacity would find industry as a whole short by at least 20 per cent of the minimum number of skilled workers necessary to operate plants on a continuing basis of efficiency and profit. . . .

Share the Burden of Training

What can be done to remedy the shortage? In my opinion the job will be done by industry. There will be direct procedure by individual plants, collective procedure by individual industries, and cooperative procedure in connection with educational institutions.

First and foremost there is going to be a less selfish attitude on the part of the individual plant. It is a matter of history that relatively few plants have carried the training burden in the past.

Any plant will lose a part of the workers it trains as apprentices. However, the plant that really wants to keep them can do so by making wages and working conditions attractive enough. Or it can let them go without prejudice, knowing that in the natural shifting of workers, a fair balance of first-grade workers will gravitate to the first-grade plant.

There is an undoubted advantage to the migration of workers. The skilled man who comes to rest after he has worked in a number of plants is almost certain to have a better background of experience than if he has spent all his time in the plant where he was trained as an apprentice.

The training itself will be conducted according to the abilities of the plant concerned, and the ideals of its executives. Some plants will run their programs themselves, putting them in charge of men trained to conduct them. Others will depend upon collective handling, which could be done by an individual employed by the group or in connection with an educational institution.

In all cases the actual experience of the apprentice on the machine, at the bench, and on the floor should be accompanied by instruction and supervision by skilled men and foremen.

But the apprentice needs more than training in manual skill. He needs his mind trained and his education supplemented. This can be done best by the trained educator.

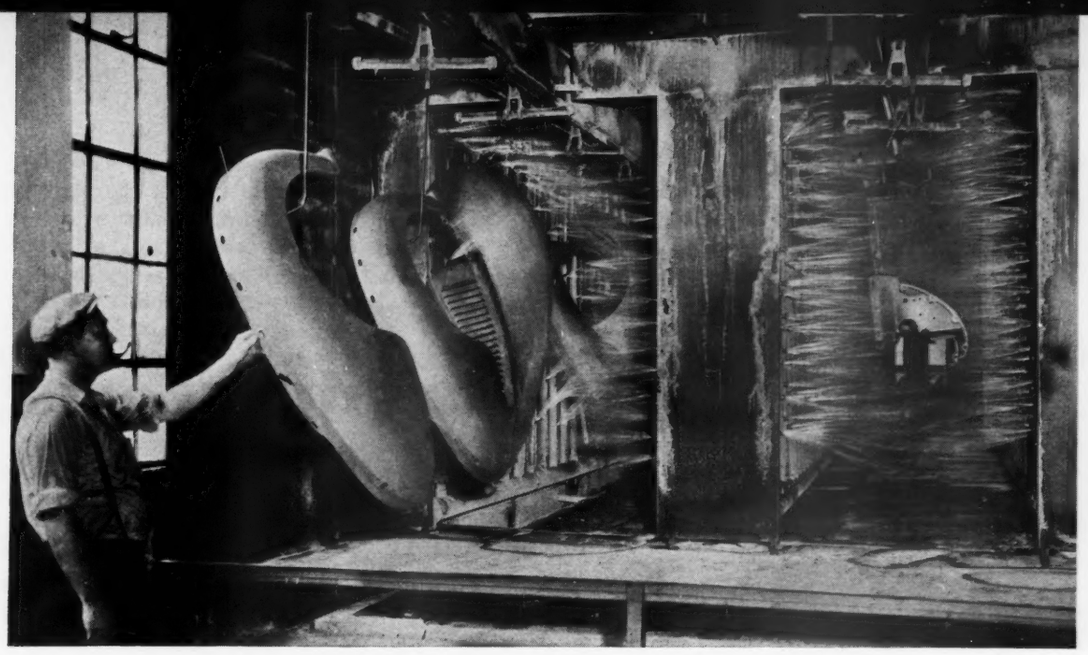
From an address by L. C. Morrow at the Tenth Annual Industrial Conference, Rutgers University, September 12, 1935.

CORRECTION

IN THE article "We Centralized Typing," August issue, the final paragraph on page 343 contained this statement, "A saving of 5 per cent in non-productive time for set-up results." This figure should have been 57 per cent. The entire paragraph is reprinted correctly below.

"Continuous-form letterheads are being used for correspondence. Such forms are prepared in sets of fifty, and are used with shifting carbon. A saving of 57 per cent in non-productive time for set-up results; the work is kept clean since the operator does not touch the carbon paper, and the grade of paper and printing is maintained at the same quality standard formerly used on cut letterheads. Production has increased 12 per cent."

In the second half of the same article (Sept., page 375), the lines "over the three years that have now elapsed since the centralized stenographic department was originally organized" should have read simply "over the period of three years." They have been checking delayed replies for 3 years; the department has been in operation for 10 years.



They Know and Use What's New

Buick is quick to adopt a new rustproofing process as part of its $14,500,000 program to keep abreast of technological advances

COINCIDENT with the announcement of a new rustproofing process comes word of its installation at Buick Motor Company, which embarked recently on an extensive program of modernization aimed obviously at making a better product at lower cost—in the interest of wider distribution.

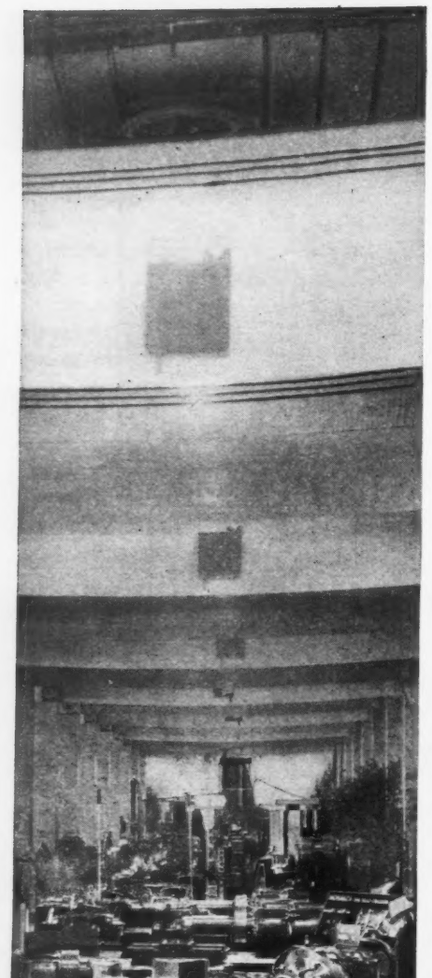
Latest development of the Parker Rustproof Company, this new process of preparing metal parts for the application of finishes employs the spray instead of the immersion method, is said to have the following advantages:

1. Greater rustproofing efficiency.
2. Lower working temperatures, better working conditions.
3. Higher output for a given floor space.
4. Higher output per dollar expended.
5. Freedom from carry-over of inert materials on the part being rustproofed, hence higher quality of finished product.

The spray process is a further development of the basic Bonderizing system, which consists of giving metal parts a phosphate crystalline coating that not only prevents corrosion under the finish but also stops the spreading of corrosion from accidental scratches penetrating to the bare metal. This Buick installation is automatic from start to finish. Parts are carried through on two continuous overhead chain conveyors. Steps are eight in number:

1. Kerosene wipe, not so much to remove oils as to break them up.
2. First hot water pressure spray, to remove virtually all dirt.
3. Second hot water spray, for additional cleaning.
4. Third spray, in which a weak acid solution has been added to the hot water to condition the surface.
5. Inspection for cleanliness.
6. Rustproofing—takes 1 minute as against 5 minutes with the immersion method.
7. Cold water spray rinse, to wash off any slight carry-over of the rustproofing solution.
8. Acidified spray rinse, to fix the phosphate coating, and prevent any chance of weakness developing under the paint.

Rustproofing solutions are held to close tolerances in Buick's spray system. Portholes enable the chemist to see what's going on inside



As Machine Tools So Industry

Technological developments in machine tool industry serve notice on plant operating men that now is the time to modernize for profit

IMPORTANT industrial event for September was the Machine Tool Show held in the Cleveland Public Auditorium, first since 1929. It came at the beginning of a period when industry cannot do better than take stock of its ability to make its products at the low costs so essential to wide distribution and to the higher standards of living that alone can bring lasting prosperity.

The Machine Tool Show proved that some 200 equipment manufacturers have not been sitting around these past six years bemoaning the utter lack of business; they have been engaged in tireless, intensive development.

Barometer of Industry Progress

This is important to the manufacturing industries because the equipment for industry can be only as good as the machine tools on which it is made. Machine tool progress is industry progress. Six years of development on the part of the manufacturers of machine tools, accessories, and related machine shop products may be taken as fairly representative of the technological advances made in other types of equipment over the same period. And if those changes are representative, the plant operating man who has not been to the equipment marts quite recently is long overdue for a big surprise.

Here, then, as an indication of what is happening to other lines of industrial equipment, are the highlights of the 1935 Machine Tool Show. We shall let the editors of *American Machinist*, expert observers in the machine tool field, tell the story as it was told in the Show Number of that publication:

"Visitors to the Public Auditorium will at once be struck by the vast improvement in appearance in the products on display there. 'Streamlining,' a much overworked word, certainly does not properly apply to machines which do their work in one spot, but the 1935 machine tools strikingly reflect the influence of the sleek lines so prominent in the products of the automotive industry. This gain is not in beauty alone as smooth contours and inclosed construction have safety and functional attributes of real service to the user.

"Beneath the attractive outlines, visitors will be impressed by the ruggedness of these machines and the marked increase in cutting speeds now available. These have been provided to meet the high performance potentialities of the newer cutting materials, such as cemented carbides, Stellite, and the improved high-speed steels. In 1929 tungsten carbide was little more than an experiment; few machines then had the capacity to use it to its fullest.

Less Handling Time

"Speed increases have been accompanied by a step-up in power and a general improvement in rigidity. But increased output of the new designs is not attributable alone to higher revolutions or linear feet per minute. In many instances this objective is attained by multiple tooling and by devices designed to reduce handling time.

"To a marked degree, the machine tools of 1935 reflect the demands of the automotive industry which they have served so ably. They show a trend toward specialization, toward sequential operations in one set-up and toward multiple cuts taken simultaneously. This specialization avoids the inflexibility of the first 'single-purpose' machines. In many designs, unit construction or provision for adjustment make it possible to accommodate high production machines to change in product design at little or no cost.

"Lessons learned in the more specialized tools have been applied to good advantage to the more standard units. These, too, have been given wider feed and speed ranges and are arranged for greater ease in manipulation.

Precision Output No Rarity

"All classes of machines show improvement in precision. Tools able to turn out work to limits of ten-thousandths of an inch on a production basis are no longer a rarity; many have built-in devices for measuring the work in process.

"Mechanically minded observers will naturally be curious to find out how these many advances in speed and precision have been obtained. Machine tool designers have been quick to adopt new materials and parts of their products. Alloy steels, properly heat-treated, are employed to strengthen shafts and gears. Normal physical characteristics of cast iron are augmented by the use of nickel and other alloying elements. Liberal use of ball and roller bearings permits higher speeds, simplifies construction, makes bearing adjustments possible, and prolongs the accuracy originally built into the machine.

"Another aid in maintaining precision is the improved means used to provide lubrication to gears, ways, and bearings. On the majority of units, continuous and sight feed systems make oiling automatic and foolproof. Cam-operated oil supply systems are popular, as well as pumps driven independently or by the machines themselves. Formerly such arrangements were confined to the main driving units, but now auxiliary and secondary mechanisms share in the benefits of continuous lubrication.

"What has been said of oiling also applies largely to coolant supply. Higher cutting speeds give added importance to a generous flow of cutting compound. Machines designed for work on materials requiring pumps and piping usually have ample capacity to flood the work under cut.

"Probably the most outstanding operating change since the last Machine Tool Show is the greatly improved control means now provided. Whether the designer has employed a mechanical, electrical, or hydraulic medium for this purpose, he has striven to put the tool completely under the operator's direct command. These designs reduce lost time between cuts, decrease setting-up operations, and lessen the worker's fatigue. Speed, feed, and rapid traverse can usually be controlled from a central operating position.

"Control devices are no longer hung on the machine as unsightly appendages; they are designed with the main frame as a harmonious unit. Flange-mounted horizontal or vertical motors together with well-conceived control apparatus aid in producing smooth designs.

"Since the 1929 Show, advances in broaching, in gear punching, in grinding, and in precision boring have been especially noteworthy. Broaching, for years confined to irregular shaped holes and splines, has become an external operation. Large castings are forced past a series of broaching cutters, which in many cases finish all plane and curved surfaces that can be machined in a given direction.

Emphasis on Quality Production

"If any general comparison can be drawn between the current show and that held six years ago, it might be observed that while in 1929 emphasis hinged largely on increased speed, the 1935 machines reflect improvement in the quality of work produced. More efficient manufacturing performance has not been neglected—in fact, the machines on display give evidence of great ingenuity in this direction. But these time-saving facilities are not made at the cost of quality. Some processes call for extra operations to give a high degree of finish and close adherence to tolerances."

Engineering Index Still Needs Funds

SIX MONTHS ago industry got the good word that the Engineering Index was to continue. Because of the great cost of assembling and classifying its wealth of technical information, the Index had been in financial straits. Then came the organization of Engineering Index, Inc., a non-profit institution, and an appeal for a working capital fund of $160,000 that would carry the Index through a five-year period and make it self-sustaining at the end of that time.

That appeal was made by a committee of engineers, educators, and industrialists headed by Dean Collins P. Bliss, Dr. Frank B. Jewett, and Dr. John V. N. Dorr. It was directed to American industrial corporations, which benefit directly or indirectly through the application of engineering science. It was made on the broad principle that industries are interdependent, that the need to keep technical information available to all in an organized, classified manner is a general industrial obligation.

To date a number of corporations have responded, with contributions ranging from a few hundred up to ten thousand dollars. The fund is not yet complete.

Like the Index Medicus

For the information of those who do not know and use the Engineering Index, it has much the same status in American industry as the Reported Decisions, the Index Medicus, and the Chemical Abstracts have in their respective fields. For engineers it is an index of current literature that is authoritative and complete. It is instantly available whenever it becomes necessary to learn what others have found or are doing along a particular line.

The Index is published in two forms. The annual volume corresponds, roughly, to indexes in other fields. Its card service, however, seems to be unique. It is a cumulative card index of technical literature subdivided into approximately 280 sections. These sections can be had in any desired combination.

About 2,000 publications from 40 countries and in 20 languages are reviewed by Index editors.

You Want to Know

. . . and the editors will gladly tell you . . . more about the things mentioned on this page

• HOW to compensate salesmen is a nice, knotty problem. If you care to know how some hundreds of companies handle it, there's a free report. (10501)

• STRIP STEEL manufacturer ships on non-returnable skids, includes a returnable lift truck in case customer hasn't the necessary mechanical equipment. (10502)

• FUSE PLUG sheds bright neon light when fuse is blown, is restored to service by a slight twist that engages one of six renewal links, costs no more than six separate plugs. (19503)

• DAZZLING diesel-eers aren't turned out in 15 mail-order lessons, warns a large university in its announcement of an extension course in diesel engineering. (10504)

• GLASS that is invisible and non-reflecting was installed in a New York jewelry store last month. Made of fine plates, laminated, it is curved to present a slightly concave surface. (10506)

• RESISTANCE to prolonged flexing, sunlight, strong corrosives, water, oxidation, is claimed by makers of a new synthetic rubber-like material. (10507)

• DAILY report form for watchmen contains questionnaire as check on performance of duties, includes a 1-minute lesson designed to instruct the watchman in his responsibilities. (10508)

• TO RUSTPROOF steel there's a new electroplating process that deposits bright plating of zinc on steel surface. (10509)

• DIRECT loans to industry? Machinery created by government to finance business has not worked any too well, says a report. (10510)

• ORIGINAL container can be converted into power gun for industrial lubrication by means of new high-pressure, air-operated pump. (10511)

Turn the wheels of this perpetual monthly calendar to find day or date for any year in this or the past century. Housing is molded in one piece (10514)

• LONGER life, better braking, are among the claims made for two new brake lining resins. (10512)

• STEAM-JACKETED pumps—new line for viscous liquids—will handle pressures up to 300 lb. per sq.in., temperatures up to 650 deg. F., with capacities ranging from 10 to 2,500 gal. per minute. (10513)

• AT LAST a device that makes it unnecessary for a golfer to stoop in retrieving his ball from the cup. (19515)

• SLIDE fasteners now come in plastic material that can be used where metal can't. (10516)

• IGNORANCE of the law will not save us from a lower standard of living when we destroy democracy, replace it with a clumsy autocracy whose inefficiency wastes much of the country's income—says one industrialist in a free pamphlet covering his views of the present economic situation. (10517)

• SMALLEST and lightest electric drill handles drills up to ¼ inch, was designed for one-hand operation, weighs only 2½ pounds. (10518)

• SMOKELESS coal now comes compressed into 4-in. cubes, six cubes to the 15-lb. package. (10519)

• SWITCH, new, is for single or, when side walls are off, for gang installations. When main cover is off, circuit is disconnected, switch and fuses are dead. (10520)

• STANDARDS of practice for certified electrical repairing insure the kind of service the equipment user wants. Want a copy? (10521)

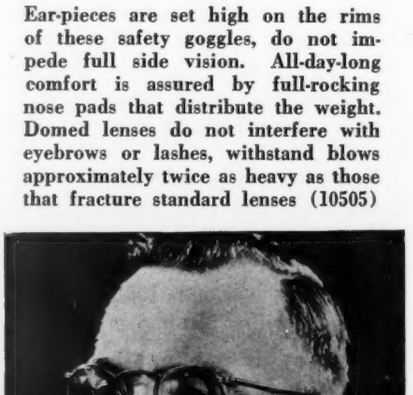
• TWO extruded aluminum sections are assembled to make a safe convenience outlet mold and wiring raceway that carries telephone, radio, and lighting wires simultaneously. Outlets may be installed at any point. (10525)

• ROOM humidifier will evaporate up to 12 gallons of water a day, costs about a cent a day to operate. Automatic operation. (10522)

• LARGER moldings require new materials, hence a new phenolic compound specially developed for instrument cases, business machine housings, boxes, containers. (10523)

• MOBILE X-ray equipment for the critical inspection of welds on pressure vessels is mounted on an industrial truck, but for safety's sake is moved to the job truck and all by crane. (10524)

Ear-pieces are set high on the rims of these safety goggles, do not impede full side vision. All-day-long comfort is assured by full-rocking nose pads that distribute the weight. Domed lenses do not interfere with eyebrows or lashes, withstand blows approximately twice as heavy as those that fracture standard lenses (10505)



When Motors Serve as Brakes

They afford several advantages, sometimes including regeneration of energy, that are not obtainable with common types of brakes

R. F. EMERSON
Industrial Engineering Department
General Electric Company
Schenectady, N. Y.

NORMALLY the function of any motor is to furnish power for operating some machine. However, a motor can be and often is used as a brake and in this service it offers certain advantages not obtainable with most types of mechanical brakes.

With the usual type of mechanical band or shoe brake, regardless of how it is set, adjustment is required occasionally to compensate for wear of brake linings. Ultimately linings or shoes must be replaced. These disadvantages are absent when braking is obtained by motors, because mechanical friction is entirely absent, aside from the small amounts present in motor bearings, commutators, sliprings, and brushes.

Ordinary electric motor braking is of three types, termed respectively regenerative braking, dynamic braking, and reversed-power braking. The latter is commonly known as "plugging."

Three Ways of Braking

In regenerative braking the motor is driven by the load and runs as a generator. The regenerated power is returned to the electric power lines and can be used to operate electric lights or other motors. If no lights, motors, or other loads are in the circuit to absorb this regenerated power, the braking energy is lost. Therefore, it is important that circuit breakers and fuses be of sufficient capacity to prevent loss of load during regenerative braking.

With dynamic braking, the current generated is circulated through a resistor instead of being returned to the power lines. This power is, therefore, not recovered but is dissipated in the form of heat in the resistor.

When braking by plugging is employed, the motor neither returns power to the line nor dissipates it in a resistor, but actually takes power from the supply. Plugging is, therefore, less economical in the matter of power used than either regenerative or dynamic braking.

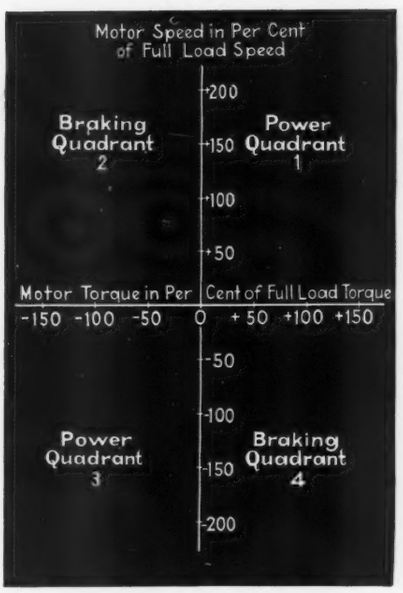


Figure 1. Quadrants *1* and *3* represent motoring loads. In quadrant *1* the motor hoists a load; in *3* it revolves in the opposite direction and drives the load down. Quadrants *2* and *4* represent braking loads. In quadrant *2* the motor exerts braking torque to slow down a hoisted load, whereas in *4* it exerts braking torque to hold back a load that is being lowered. Braking conditions represented by quadrant *4* are those mostly encountered on industrial drives

For any one of these three types of braking a spring-set or weight-set solenoid or Thrustor brake can be mounted on the motor shaft or on the shaft of the head pulley. This brake will always stay released unless the electric power fails; then it will set and hold the load.

Reference to Figure 1 will help to make clearer the relationship between motor braking and speed.

A general-purpose, squirrel-cage induction motor will give regenerative braking with an overhauling load. The part of curve *2* that lies in quadrant *4* of Figure 2 indicates that no regenerative braking is obtained at speeds less than synchronous. Also, it shows that for all loads within the capacity of the motor, the speed regulation is excellent. If an overhauling load is increased from zero to 100 per cent,, the speed increases only from 100 to 104 per cent.

When Applied to Conveyors

Retarding conveyors are often operated with this arrangement. The motor may be started on full voltage, and exerts starting torque as represented by point *A*, quadrant *3*. Since the motor is assisted by gravity, it quickly overcomes the friction and inertia of the system, taking power from the line while doing so. Then, because the gravity load is sufficient to overhaul the motor, its speed passes through synchronous value. At this point the motor ceases to take power from the line and starts to regenerate, acting as a brake.

Speed of the conveyor will not vary much, regardless of whether it is overloaded or nearly empty. This method of drive does not provide speed variation, but usually that is not required.

The portion of curve *1* that lies in quadrant *4* represents reversed torque or plugging torque; that is, the motor is taking power from the line and the torque is tending to raise the load, but the load is sufficiently great to overhaul the motor. This curve in quadrant *4* represents an unstable condition, since any load sufficient to reverse the motor will cause it to overspeed. Also, the motor will draw an excessive current.

If a high-slip, squirrel-cage in-

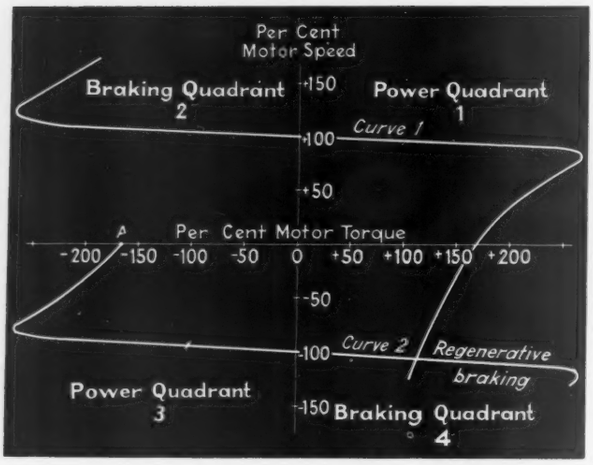


Figure 2. Speed-torque curve of a general-purpose, squirrel-cage induction motor. On a conveyor drive, curve *1* in quadrant *1* applies when the motor is driving the conveyor up-grade. Curve *2*, quadrant *3*, applies when it is driving the conveyor down-grade. Curve *3* in quadrant *4* represents motor regeneration when the overhauling load tends to run the motor above synchronism

duction motor is used as above, the same comments will, in general, apply except that speed regulation will be poorer. Changes in overhauling load make correspondingly greater changes in speed.

When a motor with a double squirrel-cage winding (the high-torque, low-starting-current motor) is used, it has the disadvantage of a lower breakdown point in the torque curve. If a load exceeds this point, overspeeding will result. The high starting torque of the motor is of practically no use, since the overhauling load of a retarding conveyor leaves very little for the motor to do during the period in which it is accelerating.

For Braking with Speed Variation

The general-purpose type of squirrel-cage induction motor with good speed regulation and high breakdown torque is usually best for a continuously running overhauling load, such as a retarding conveyor.

A wound-rotor induction motor running with rings short-circuited will furnish regenerative braking for an overhauling load and behave similarly to a general-purpose, squirrel-cage, induction motor. One additional important feature—speed variation—is obtainable when using this type of motor for braking a load regeneratively, but only at speeds higher than synchronous. It is secured by inserting resistance in the motor secondary.

This feature is used with various types of hoists, such as slope and crane. A load of material is raised on a hook or by a bucket or car and the carrier is returned empty. It is considered good practice in many instances to return the empty carrier to the loading place at a speed 50 or even 100 per cent higher than the hoisting speed. This can be accomplished by inserting the correct amount of resistance in the motor secondary and obtaining regenerative braking at the higher speed.

Referring to Figure 3 it will be noted that curves *1* and *2*, showing motor operation with rings short-circuited, correspond to the squirrel-cage motor curves in Figure 2. The remaining curves indicate operation with various amounts of resistance in the motor secondary.

Assume that the operator of a crane or slope hoist lowers an empty bucket; the overhauling load is equal to 37½ per cent of full-load motor torque, and the required speed is 175 per cent of synchronous speed. He turns on the controller, connecting the motor to the line with all resistance in the secondary. The controller is then quickly advanced to the Full On position, which short-circuits the motor rings and places the motor on curve *2*, Figure 3, as will be seen.

Speed Control Is Important

Assisted by gravity the motor comes up to speed very quickly. At first, it may take power from the line, quadrant *3*, to help gravity in overcoming friction and inertia. As the descending load approaches the speed for which it is geared, the motor speed approaches synchronism. The motor will always arrive at synchronous speed when the motoring load falls to zero, irrespective of the position of the controller handle.

With the controller in the Full On position, the speed arrives at Point *R* on curve *2*, Figure 3. Since the desired speed is 175 per cent of synchronous, the controller is turned to that point, represented by curve *3*, and the speed increases to 175 per cent as point *Z* on curve *3* indicates.

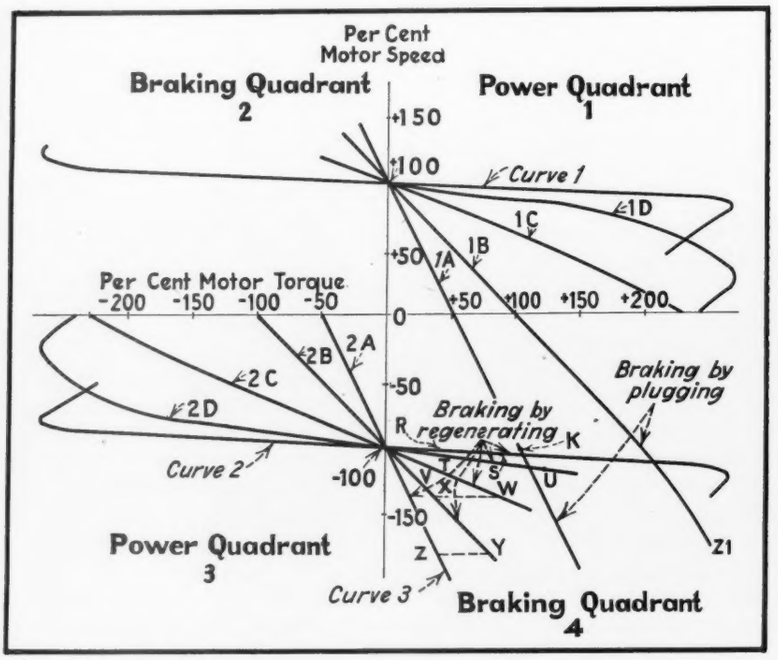


Figure 3. Speed-torque curves of a wound-rotor induction motor. Curves *1* and *2* are similar to those in Figure 2 for a squirrel-cage motor. Other curves show conditions obtained by inserting external resistance in the motor secondary

Curve *3* represents a more unstable speed condition than curve *2A*. Where an operator is handling the controller, variations in load can be corrected by moving the handle a notch or two one way or the other.

When running at 175 per cent of the regular operating speed, it is important to be able to slow up and stop without large, sudden increases in torque. With machines operated by ropes or cables, such as slope hoists, sudden changes in torque may be accompanied by violent whipping and slapping of the cables. This is usually brought about by the operator reversing the controller too far in the hoisting direction and plugging the motor, causing it to exert too much torque in the reverse direction.

This condition should be avoided, which may be done by correct proportioning of the external resistance values and proper handling of the controller. If the motor is regenerating at 37½ per cent torque and 175 per cent speed, and the operator plugs to the second point of the controller in the hoisting direction, he produces conditions represented by *Z1* on curve *1B*, Figure 3, which makes the motor exert 250 per cent torque for hoisting. If the controller is maintained on this point, the load will be brought to rest, after which the motor will reverse and start to hoist the load.

The Proper Way to Do It

The proper procedure would be to advance the controller to the Full On position in the lowering direction, which would slow the speed from 175 to about 103 per cent. In going from point *Z* on curve *3* to point *R* on curve *2* through points, *Y, X, W, V, U, T, S,* it will be seen that the torque peaks are maintained at smaller values than if the operator plugged the motor at this high speed.

It is usually a little confusing to an operator to slow up the operating speed by cutting out all the secondary resistance, because this same operation gives an increase in speed when the motor is working under a motoring load. It is only necessary to remember, however, that the speed approaches synchronism when the motor rings are short-circuited, no matter whether the motor is running at a very slow speed with a motoring load or whether it is running at, say, double speed with an overhauling load.

After the motor has reached 103 per cent speed, the operator can safely plug to the first point of the controller in the hoisting direction (point *K*, curve *1A*), and as soon as zero speed is reached the controller handle can be brought to the Off position, which will allow the brake to set and hold the load.

It was previously stated that when a motor slows down its load by regenerative braking, all such braking occurs at speeds greater than synchronous. It will be seen that, with the motor on a plugging connection, speeds between zero and synchronous can be obtained. With this method of operation, however, power is taken from the line instead of being returned to it, and the speed regulation, particularly with light loads, is not close. With any change in load the resultant change in speed may be excessive.

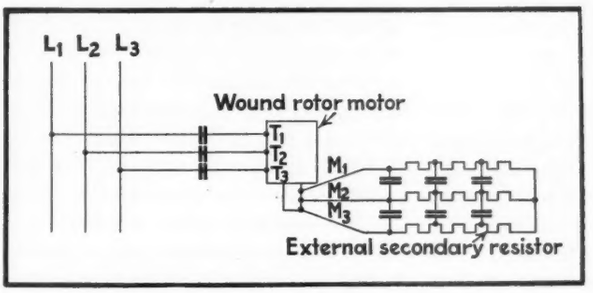


Figure 5. Elementary connections of a wound-rotor motor where braking effect is required

In some instances where it is desired to get good speed control by braking a descending load, one phase of the motor stator can be excited from a d.c. source. Then by varying an external resistance in the motor secondary, it is possible to get braking effect at speeds as low as 5 or 10 per cent of synchronous. This method has been used on large hoists where very heavy loads must be lowered carefully.

One disadvantage of this method of operation is the fact that the resistance of one phase of the ordinary induction motor is so low that a d.c. voltage on the order of 15 or 20 volts is necessary. This usually requires a small motor-generator set with a specially wound, low-voltage generator to furnish excitation.

However, the speed control by this method has excellent characteristics. A very low speed is possible with a heavy load, and considerable variations in load on any given point of the controller do not give large variations in speed. Speed regulation is, therefore, generally good.

With this arrangement no "kick-off" is available; the gravity pull on the load must be sufficient to break static friction and move the load.

Speed-torque curves for a motor operating under these conditions are laid out in quadrant *4* of Figure 4. The fact that none of these curves runs into quadrant *3*, shows that the motor can exert no torque to drive the load downward.

Figure 5 shows the elementary connection diagram of a wound-rotor motor arranged for braking. Different degrees of braking effect are obtained by varying the amount of external, secondary resistance.

(A succeeding article will discuss characteristics of braking with d.c. motors.—Ed.)

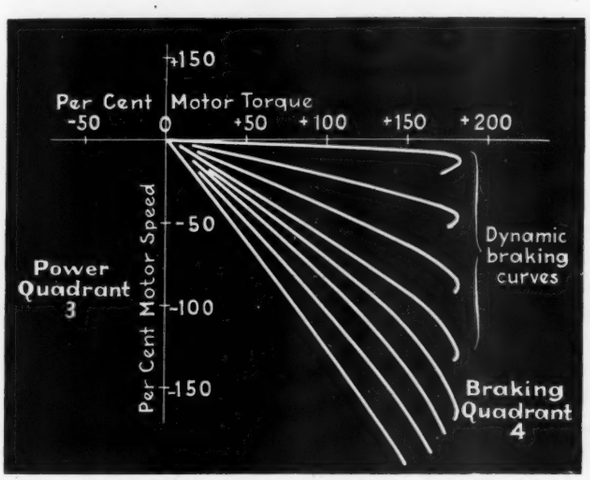


Figure 4. Dynamic braking curves obtained by exciting one phase of the stator of a wound-rotor induction motor with direct current

Wasted Heat Warms Nobody

One right way to run a heating plant: Put right amount of heat in right place at right time at right cost

G. W. BORDEN
Construction Engineer
New York Dock Company, New York

EFFICIENCY in the control and distribution of heat in buildings is too often disregarded, and any dissatisfaction with results is blamed on the generating plant. There are various methods of heating, but without the proper layout and control for each system, inefficiency is inevitable.

Factory and storage buildings are commonly heated by steam distributed through a two-pipe system. The steam leaving the boilers is fed into the heating system through large mains, from which it branches off to the heating units. It is trapped to secure complete condensation at these units and returns in a separate pipe system, by gravity or pumping, to the boiler room. Efficient passage of the steam through this cycle is as important as the boiler-room layout and operation.

Check These Causes of Heat Loss

There are several primary causes of heat loss in the passage of steam through its distribution cycle which it is important to eliminate or correct:

1. Steam mains should be insulated with 1 inch of asbestos covering protected with a light cloth fabric and banded in place around the pipes. This covering can be painted.

It is not considered necessary to cover return lines. If they discharge into large mains, these may be protected.

All mains passing through cold areas or adjacent to openings in exterior walls should be especially protected to avoid freezing and prevent excess condensation.

2. All possible condensation should take place at the heating units. These units extract the heat from the steam at the proper location for starting the air in circulation and giving it the correct direction of travel. In this way the heat reaches all portions of the space to be warmed and does not collect at the ceiling or become dissipated at some location where it is not needed.

3. Flow of steam in mains should not be restricted by inadequate sizes of piping. If present, this condition causes a slower flow of steam which results in more condensation in the mains and failure to furnish the heating units with the proper amount of steam for efficient operation. Another result is that the units farthest from the source of supply receive the least steam; hence there is an uneven distribution of the heat.

4. Eliminate condensate as soon as possible from all lines and units. All heating lines should slope away from the main riser, and the condensate from them should be trapped at low points into the return line system. Branch feed lines to heating units should be taken from the top of the heating mains to prevent condensate from running through the units. Traps should be placed between the units and the return line, with a "cooling leg" large enough to permit the unit to be drained of condensate at all times. This arrangement is necessary because most traps require a small amount of condensate to float the valves. In some types of unit heaters "cooling legs" are an integral part of the heating coils. Pitch all units to drain properly in order to return the trappings.

To Increase Heating Efficiency

Other practices that will increase efficiency of heating are:

Heaters in this new building have been located to give proper circulation of air. In summer the fans can be used for cooling. Absence of piping along the walls adds to the appearance

1. Use two pressure-reducing valves in series to reduce from high to low pressure, allowing each valve to reduce the pressure head by one-half. This arrangement gives better steam flow control and lessens wire-drawing of valve seats.

2. Place strainers between heating units and traps to keep traps from clogging with sediment from the heating system.

3. Provide each heating unit with an air valve if used on a closed system. Unit heaters may usually be used with high- or low-pressure steam. Where high-pressure steam is used, the total length of the coils can be reduced at the factory, if so ordered, or they may be used as delivered for low pressure, since they are usually tested for 125-150 pounds pressure.

Steam pressure in radiators should not exceed about 15 pounds for safety of operation.

What Heating Unit

Next item of importance is the location of heating units and the type to be used. Radiator coils in factory areas are to a large extent being replaced by unit heaters although they are still considered effective in offices. Coils should be located at cold walls, near doors, and under windows to heat cold air that enters, and should be placed as near the floor as possible. If placed high up on walls or on ceilings, their effect is minimized because the natural buoyancy of the heated air causes it to stay in a layer at the ceiling, whereas the air at the floor is much cooler—often too cool.

To avoid such conditions, unit heaters were developed with motor driven fans to circulate the heated air. In large areas these units should be placed along cold walls, so as to blow obliquely toward and along them. If a series of heaters is employed, the units should be placed to rotate the air about the room in a circle. Each successive heater then picks up the partly cooled air from the heater behind, reheats it, and passes it on to the heater ahead. The shutters on these units are tilted (they can be adjusted as desired) at about a 30-deg. angle with the ceiling, thus forcing the air toward the floor, where it fans outward in funnel shape and then curves slowly upward toward the ceiling. In this way the air at the floor level is kept heated, and the room temperature will be more uniform.

It is usually better to use a larger number of small units than a smaller number of large ones in order to secure more even distribution of heat. There is a tendency for these heaters to produce a blasting effect immediately in front of them. Men working in front of the heaters may complain of too much heat, whereas those slightly to one side may be only comfortable. With smaller heaters the blast is scarcely noticeable.

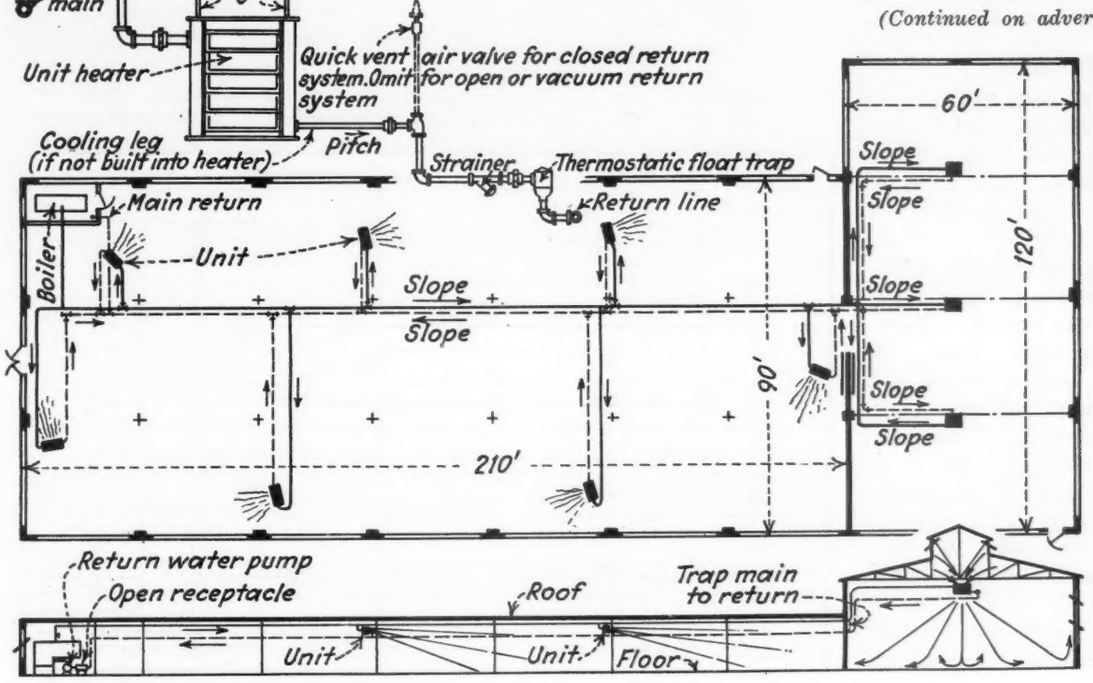
Always watch out for partitions, large machines, and other obstacles that may present a resistance to air flow and break the circuit around the area. If heaters are located so that they blow toward these objects, do not expect to get heat on the other side.

A peculiar situation exists in very large areas in that there are shiftings and currents of air which are independent of exterior conditions. In such cases it is necessary to install one or more additional unit heaters across the area to prevent this shifting. For example, if the prevailing cold winds are from the west, the general shift of the room atmosphere is eastward. Hence, a battery of heaters blowing westward should be placed across the area near the east wall.

Thermostatic Control

Automatic control of heat in buildings has also become an important part of operation. It is usually accomplished by the use of thermostats. With unit heaters they control the circuit to the fan motors or, on non-motorized units, the flow of steam. This latter method of control is rather expensive, however, and is not much used. Other methods of control by thermostats are based on shutting off main steam valves or fuel supply (oil or gas), regulating drafts, and so on. These systems are usually suitable only for small plants or building areas of one unit.

(Continued on advertising page 80)



Heater connections for a low - pressure system. Condensate flows by gravity to an open receiver

Layout of unit heaters for a low - pressure system with gravity return. Note the circular direction of air flow

Lighting Does a Production Job

Management could go just so far, but not far enough, in reducing losses from defective work; then found that better lighting did the rest

BERNARD SHEREFF
Standards Department
American Hard Rubber Company
Butler, N. J.

INDUSTRIAL lighting, like visiting the dentist, is something in which we know we should take more interest. Possibly one of the reasons why we do not is that no one can give definite figures showing where and how much we are losing through poor lighting conditions. Besides, we may overlook the importance of improvements that will increase workers' comfort, even though no money savings can be effected.

An improvement of this sort created active interest in lighting at the Butler Plant of the American Hard Rubber Company. Motion studies were made of comb inspection. In such studies the comfort of the operators is always questioned.

So a Lighting Survey

We found that the inspectors had difficulty in working on black combs against a dark background. The inspectors tried various light colors and found that a light blue background was best. It was then found that selection of a suitable color for the background was of little help on some jobs, where the fatigue was due to the lighting. Therefore, it was decided to make a lighting survey.

The local lighting company cooperated by sending one of their engineers to make the survey. Foot-candle readings were taken at various points where conditions seemed particularly bad or special care has to be exercised. Readings were taken on the afternoon of a cloudy day, and again on the morning of a bright day. In a number of instances comparisons of daylight alone, and daylight and electric light, were made.

A lighting committee was formed, with the plant master mechanic as chairman. Several improvements that did not require large expenditures were made to pave the way for a regular program.

For example, in one department the lights, originally mounted on the ceiling, 30 feet above the floor, were lowered 8 feet. Illumination on the workbenches was increased and maintenance made easier, since the fixtures can be reached from the traveling crane. This building has good daylight facilities; so changes were made only in the section used at night. Walls in this section were whitewashed.

A dust collector was installed in another department because a blower, previously used without a collector, scattered dust on inspection benches near the windows and cut down the light reflection. Windows in this and an adjacent building had always been a dingy brown. Now they can be kept clean, doubling the illumination.

On a desk in front of an open window the illumination was 500 foot-candles; with the window closed, it was 220 foot-candles. This discovery led to a better window-cleaning program. Wage incentives were set up. Our window cleaning budget is no higher than before.

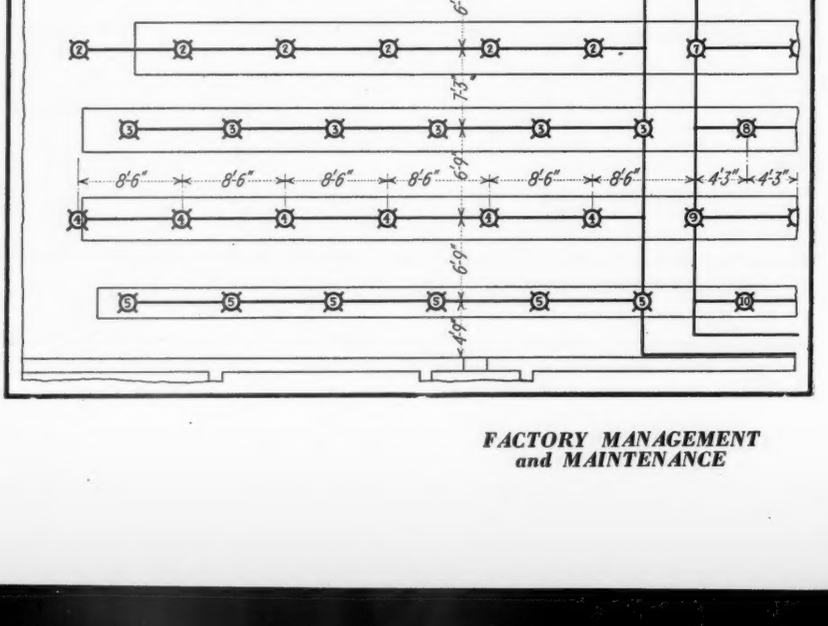
Operators Suggest Improvements

Several operators, hearing of these improvements, suggested changes at their own workplaces. These changes were made. None was expensive. Usually the change required only the addition or moving of a few fixtures.

Some operations are difficult to illuminate properly with ordinary RLM reflectors. Special-purpose lights, such as industrial spotlights, may be the answer. We found that lighting equipment manufacturers would cooperate by lending their equipment for trial. This makes it possible to experiment without fear of wasting money if these special fixtures prove unsatisfactory.

So far we have made only one really expensive installation. This

Layout of the new lighting system in the comb-sawing department. Units in adjacent rows are staggered for better light distribution on the machines



is in the department where the teeth are sawed in the combs. If the comb is placed in the clamps only a few thousandths of an inch out of position, the saw cut does not register with the groove pressed in the comb blank, and the comb is rejected. Other errors or maladjustments will cause various other defects. The saw blade wears and if not resharpened at the proper time will cause rough or chipped teeth; so the operators must inspect their work constantly. Combs, after sawing, are worth about 70 per cent of their complete factory cost.

During 1934 the cost of comb damage and repair chargeable against the sawing department totaled several thousand dollars. A number of managerial steps were taken to reduce this figure. The foreman and set-up men were required to exercise more rigid supervision. Operators were informed daily of the amount of defective work and those responsible for an excessive amount were jacked up. Work of newer operators was inspected several times during the day. Finishing operations were revised slightly to make repairing more economical.

Quality and Light

In the final analysis, quality is largely a function of the operator's skill. Without proper lighting his accuracy and judgment are impaired, and damage increases. The lighting committee felt that great improvement could be made by properly illuminating the machines.

The survey showed that the illumination was only about 6 foot-candles on machines in the center of the room. It was necessary to keep lights burning during the day. Since this department runs 24 hours a day, good artificial lighting is particularly important. The pictures of one of our sawing rooms show what the lighting problem is.

Machines are mounted on benches in long rows. Windows aid only the outside rows, and operators in these rows cut off much of the daylight, since they work with their backs to the windows. Each operator runs a battery of machines; therefore he attends each one for only a short interval and moves to the next. Local lighting for each machine would be uneconomical.

In the beginning, lamps, rated from 100 to 200 watts, spaced 9 feet apart, and mounted 5 feet 6 inches from the floor, gave an intensity of about 6 foot-candles on the machines in the comb-sawing department. Now the reflectors, fitted with 200-watt, white-bowl lamps and dust-tight covers, are spaced 8 feet apart and mounted 9 feet from the floor. Illumination on machines is between 15 and 20 foot-candles

In any event it would be necessary to have general illumination for aisles, for the shafting and belts under the benches, and to prevent too great a contrast between high-intensity illumination on machines and low values elsewhere. Furthermore, lighting units near the saws would soon be completely covered with shavings. These saw shavings are small, curled, chips of rubber that are charged with static electricity, and cling to surfaces over an area of several feet.

Formerly the lamps were mounted 5 feet 6 inches above the floor in RLM reflectors. Wattage of units varied from 100 to 200 watts, since no definite study had been made of lighting requirements. Spacing of lamps was incorrect for proper distribution. Often illumination came

from directly above, and operators cast a shadow over their machines when loading and unloading.

With the help of Westinghouse Lamp Company engineers a new layout was made. Sixty-three 16-in. RLM reflectors were installed, about the same number as previously used. They are fitted with 200-watt, white-bowl lamps. Each has a pull switch so that individual lamps can be turned on as needed. The mounting height was raised to 9 feet, which improved diffusion.

To make cleaning easier, each reflector is fitted with a dust-tight cover. When cleaning is made easy, it can be done more often within the cleaning budget.

Spacing between units in the same row is 8 feet 6 inches. The rows are arranged over the middle of the benches as before. However, the units in adjacent rows are staggered by mounting them alternately 4 feet 3 inches from the end of the row. This arrangement will be made clear by comparing odd- and even-numbered circuits in the drawing. As a result there are no blind spots when an operator stands over a machine. The fixture in the next row supplies sufficient light to work by, even if the operator is standing directly under his own light. Another benefit is better diffusion, fewer shadows.

The intensity on machines in the center of the room is now 15 to 20 foot-candles, as contrasted with the former intensity of 6 foot-candles.

A Good Investment

Approximately $1,000 was spent on the entire installation; the reflectors and covers cost about $250, and labor $250. Much of the labor and the additional material cost of approximately $500 was occasioned by the change from 220- to 110-volt current made at the same time. The work was done by the plant electricians when they were not busy on maintenance work.

The installation was completed about February first of this year, and we have had a chance to observe results. It is impossible to say exactly how much has been saved by this expenditure of $1,000 because several managerial steps were taken at the same time to reduce damage and repair costs on defective combs. Without proper lighting, however, these steps would have been less effective. You cannot hold a man responsible for quality if he cannot see what he is doing.

Damage and repair costs, however, have taken a definite downward trend since the installation of the new lighting system. The past two months show about half the damage and repair ratio of the period before making these improvements. Based on the past month's reports, this will mean about $5,000 annual saving. The average for the entire period after changing the lighting system is 25 per cent less than that before changing.

Even though we cannot determine the exact amount saved by improved lighting, there was an improvement in quality of product from the start. We know when we tell operators to watch for bad work, that they can see what they are watching for. Since the operators are not paid for bad work, they are very much in favor of the improved lighting.

Although we have had no serious injuries due to cuts or other mishaps, minor accidents do occur. Reports show that the frequency of injuries has decreased 18 per cent. It is not possible to separate night accidents from day accidents, since some men work partly during daylight hours, partly at night. Moreover, it is necessary to use artificial light during about 40 per cent of the total daytime working hours. However, the reduction in injuries is a benefit due at least in part to improved illumination.

Altogether the results obtained in the way of reduced damage, repairs, number of accidental cuts, and so on, easily justify the money we have spent for better lighting.

Electric Service Shops Certify Repairs

A PLAN worked out by leaders in the motor repair and service industry for the purpose of raising the practices and ethics of this group to a higher level (*Factory*, December, 1934) has now been put in effect in the New York metropolitan district. The group is known as the National Industrial Service Association. Headquarters are at 500 Fifth Ave. The basis of the plan is rigid specifications or standards of practice for the performance of electrical repair, service, and maintenance work.

All work done in accordance with such standards is known as Certified Electrical Repair Work, a phrase that is protected by registration and copyright. Cooperating members of the group pledge themselves to adhere to these standards of practice. In return, each member is licensed to advertise itself as a Certified Electrical Repair Shop, and to distinguish its work as Certified Electrical Repairs.

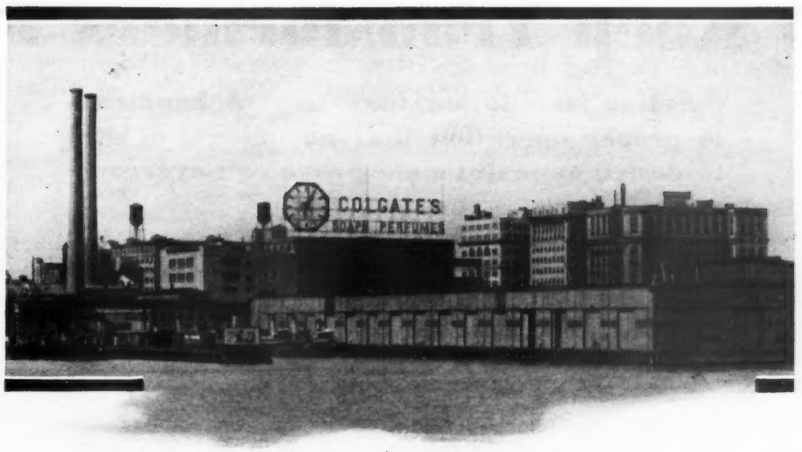
In order that motor users may identify such certified shops and their work, an emblem has been adopted and registered for the use of qualified, cooperating shops.

A certification committee has been elected to insure maintenance of the standards adopted. It is the duty of this committee to investigate the facilities, equipment, trade reputation, and character of all service shops that apply for certification. A further duty is to investigate any alleged failure to adhere to these standards.

Size is not a determining factor in becoming a certified shop; that status depends entirely on the ability and dependability in turning out work of the required excellence.

Certified work bears the following guarantee:

"We guarantee that this equipment has been repaired in accordance with the standards of service as set forth by the New York Metropolitan Chapter of the National Industrial Service Association covering Certified Electrical Repairs. We guarantee those parts which we have completely rebuilt or replaced against faulty workmanship or material on our part for a period of one year from date of delivery, provided the apparatus is returned to our plant, transportation charges prepaid, and upon examination it is proven that the defect was caused by said faulty workmanship or material and was not due to misuse, careless handling, or other factors beyond our control. A certified repair shop will remedy the defective part or parts. We reserve the right to decline responsibility where repairs have been made or attempted by others."



How We Control Maintenance

In a large plant it's important, though not so easy to get that nice balance between too much and too little control

JAY A. JACOBS
Plant Engineer
Colgate-Palmolive-Peet Company
Jersey City, N. J.

IN ANY large plant like ours—there are 44 buildings occupying portions of 7 city blocks—a good-sized force is required to keep plant and equipment in order. And to get the most efficiency out of this force of mechanics and helpers there must be careful planning, supervision, and control.

For the necessary planning and supervision, we have divided our working force into various crafts and functions. Each craft has its foreman who reports to the master mechanic who in turn is responsible to the plant engineer. Other functions—for example, the keeping of stocks or the drafting of plans for alterations—are likewise fitted into the system.

No Order, No Job

Control of maintenance work requires that no job shall be done without a written order and suitable authorization. But there are many kinds and degrees of repairs and alterations. Some are minor, involve only a few dollars of expense. Others may run into thousands of dollars. Some jobs obviously must be done; others may or may not be necessary or advisable.

Executive control must, therefore, enter the picture. But good practice requires top-executive attention only to major items and exceptions, leaving minor and routine matters to the judgment of under-executives and to predetermined courses of action.

A line must be drawn somewhere between minor and major, routine and exception. We do this by using the factor of cost. If the job is estimated to cost less than $100 and does not involve the purchase of new equipment, we call it minor or routine. No executive consideration is therefore needed. A simple work requisition describing the job, the place, and the time is all that is required. This form may be filled out by a production department foreman, by a plant engineering man, or even by the management. It must, however, have the approval of the foreman or head of the department in which the work is to be done. To become effective it requires only approval of the master mechanic.

If, however, the projected work involves the expenditure of more than $100 or if it involves new construction or the purchase of new equipment costing more than $10, the plant superintendent's approval is required. Necessarily the process of getting executive approval demands more complete information, so we have a mechanical work order which describes the job and carries a carefully prepared estimate of the cost broken down into material, overhead, and labor.

Work Orders Must Be Approved

The work requisition is made out only in duplicate, or in triplicate if the originator wishes a copy for his own records. The mechanical work order, on the other hand, is a quadruple form. The original goes to the accounting department when finally approved, one copy goes to the plant superintendent, one to the general superintendent, and one is retained in the control division of the engineering department where it originated. Before work can be started, such an order must bear the approval of the plant engineer, the

(Continued on advertising page 76)

To Keep Transformers Fit

Careless installation may impose handicaps to proper operation that no amount of skill in design or maintenance care can overcome

J. S. MURRAY
Chief Electrical Engineer
Follansbee Brothers Company
Follansbee, W. Va.

TROUBLE-FREE operation of transformers depends upon the care with which they are installed and maintained quite as much as upon the skill used in designing and manufacturing them.

Most distribution transformers are shipped without oil. Very large units, whose weight or dimensions exceed transportation facilities, are shipped disassembled. When transformers are set up in their permanent location they should be filled with oil, even though they are not to be put in service for some time afterwards. Otherwise they should be stored in a dry place that has a fairly uniform temperature and is free from corrosive gases.

When outdoor-type transformers are stored in the open, they should be filled with oil and covered to keep out rain.

Pick the Proper Location

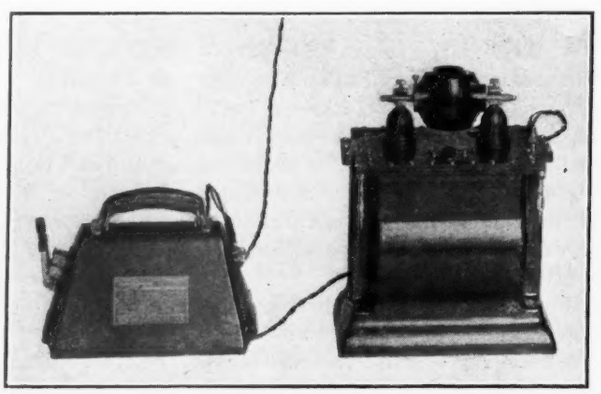
In selecting a transformer location, ease of inspection, accessibility to cranes or other lifting devices, and ventilation should be considered. With indoor locations care should be taken to avoid the possibility of rain falling or blowing on the tanks. Since self-cooled transformers depend entirely on the surrounding air to carry away the heat, especially when installed indoors, it is necessary to provide adequate ventilation.

Self-cooled power transformers should be spaced so that there is from 12 to 30 inches of space between units and adjacent walls in order to permit free circulation of air between them. When necessary, washed air in sufficient quantity should be supplied to the room or transformer vault. In general, about 20 square feet of air inlet area per 1,000 kilovolt-amperes of transformer capacity, with a corresponding outlet area, is a good average for such rooms where cooling air is required.

Water-cooled transformers depend entirely upon the flow of water through the cooling pipes for carrying away the heat; so the surrounding air circulation has very little effect on them.

When installing transformers it should be remembered that moisture will condense on any surface that is cooler than the surrounding air. Hence, if transformers or oil drums are brought into a warm room, they should be allowed to stand before opening until there is no condensation on the outside.

If transformers are ordered filled with oil, samples of the oil should be taken and tested before the units are put in service. Should the oil show traces of moisture, it must be removed from the transformers and filtered. Also, if moisture is found in the oil, the insulation resistance of the transformers should be measured; if indications of moisture are present, the transformers should be dried.



For testing the dielectric strength of insulating oils

When transferring oil to or from transformer tanks and drums, a metal hose should be used instead of a rubber hose, because of the possibility that sulphur dissolved from the rubber will attack the copper.

In the event that it is necessary to fill transformer tanks with oil when cold (25 degrees Centigrade) make sure that the oil does not rise above the level indicated on the tank or oil gage. As the oil heats up under load it will rise to a higher level, due to expansion.

After transformers have been in service a few days for the first time, it will be advisable to inspect the inside of the manhole covers for moisture. If it appears that much moisture is present, the transformer should be taken from service and the oil dried.

If it becomes necessary to dry out medium-sized or large transformers, the manufacturer should be consulted regarding the best method to be used. However, a satisfactory procedure in drying out power transformers is known as the "short-circuit" method. It consists in heating the windings and oil to a high temperature for a short time by passing a certain percentage of normal current through the windings.

The high oil temperature may be secured by blanketing the tank or reducing the flow of water in water-cooled units. If good ventilation is provided, the moisture will be driven off to the outside atmosphere and should not condense on the undersides of the cover or tank.

For this method of drying out, the following table of current values in

per cent of normal full-load current may be used, with the corersponding maximum oil temperatures.

Amperes in Percent of Full-Load Current		
Water-Cooled Transformers	*Self-Cooled Transformers*	Maximum Oil Temperature, Deg. C.
50	50	85
60	75	80
75	75	75

Additional ventilation to that ordinarily supplied should be maintained by raising the manhole cover. The cover should also be lagged with heat-resisting material in order to prevent condensation of moisture.

The drying-out process should be continued until oil taken from the bottom and top of the tank tests 22,000 volts or higher under standard conditions, for six consecutive tests, taken about four hours apart and with the oil at maximum temperature.

If the oil tests indicate a decrease in dielectric value, the indication is that moisture is passing from the transformer into the oil, and the drying must be continued. It may be necessary to filter the oil and continue the drying process until constant dielectric values are shown.

After the drying process is completed, the insulation resistance should be measured and corrected for temperature, the transformers operated at full voltage for at least 24 hours, and the oil tests repeated. One of the illustrations shows the equipment that we have found satisfactory for testing transformer oil.

When taking transformer oil samples for dielectric tests, care should be exercised in cleaning the container, which should preferably be a large-mouth glass bottle of 16- or 32-oz. capacity, with a cork stopper. After the oil has settled take samples from the sampling valve at the bottom of the tank or drum. Sufficient oil should be drawn off to insure getting samples that are representative of the oil in the transformer tank or drum, rather than that in the sampling pipe.

It is also important that the tests be conducted properly. Before the standard oil-testing cup is used, it should be thoroughly cleaned and rinsed with oil from the sample. The cup should then be nearly filled with oil from the sample container and allowed to stand for a few minutes before making the test. Five breakdown tests should be made on each filling, and the cup emptied and refilled from the original sample.

The average voltage of about fifteen tests (five tests, three fillings) is usually taken as the dielectric strength of the oil. This should be at least 16,500 volts. If values less than this are found, the oil should be filtered. Experience would indicate, however, that values of 18,000 to 20,000 volts are more reliable criteria of safe oil.

All transformers should be provided with load-indicating instruments, and the loads ought to be noted frequently. In cases where such instruments are not permanently installed, load checks should be made at sufficiently frequent intervals to indicate definitely whether the transformers are overloaded. Well-built transformers can be overloaded considerably for short periods with very little loss in life. However, large overloads carried for long periods are likely to result in marked shortening of the life.

They Require Painting

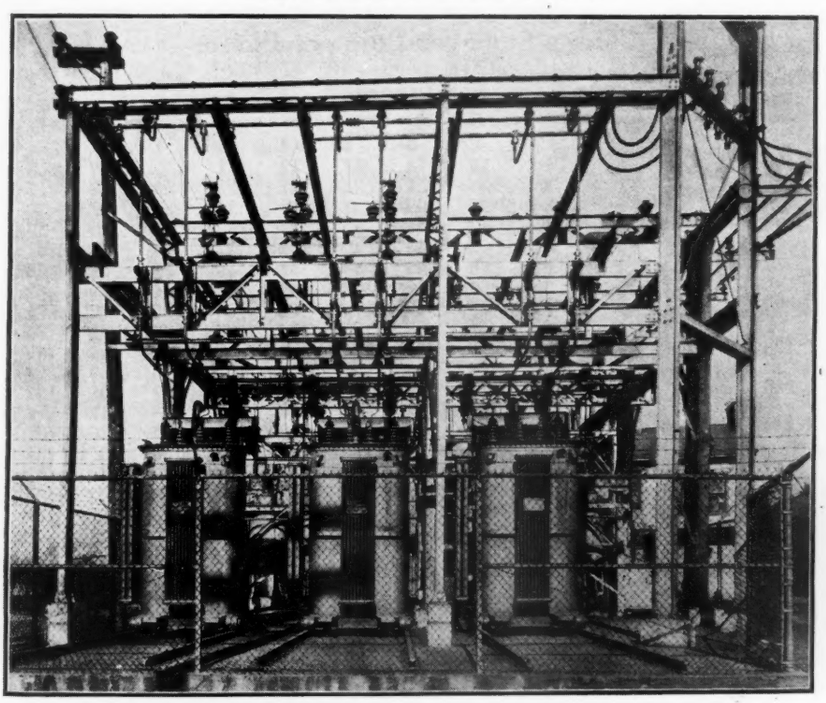
Painting of transformers is a matter of some importance on which there are a few differences of opinion. There is an impression that a transformer whose tank is coated with a light-colored paint will operate at an appreciably lower temperature in the sunshine than one that has been painted black. This impression is based, of course, on the relative absorptive qualities of the different colors, or on tests made on apparatus under conditions that do not apply to transformers in service.

We have for years used aluminum paint on our transformer tanks. This paint looks good and has good lasting qualities, particularly on outdoor work. I am inclined to think that under ordinary conditions there is little real difference in the oil temperatures of transformers traceable to the effect of various colored paints. Whatever effect there is probably lies in the direction of making oil temperatures in transformers painted a dark color, such as deep gray or black, run somewhat higher in hot weather than in tanks painted a light color.

In any event, appearance and the necessity of protecting the ironwork from rusting require that transformers be carefully painted.

(A succeeding article, scheduled for early publication, will discuss the maintenance attention that is necessary to keep transformers in good condition.—Ed.)

The tranformers in this 6,000-kva outdoor substation are rated 25,000 volts



A. C. Wave Windings

Tables and connecting diagrams make it easy to locate phase coils and connect windings that have three slots per pole per phase

A. C. ROE
Railway Engineering Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

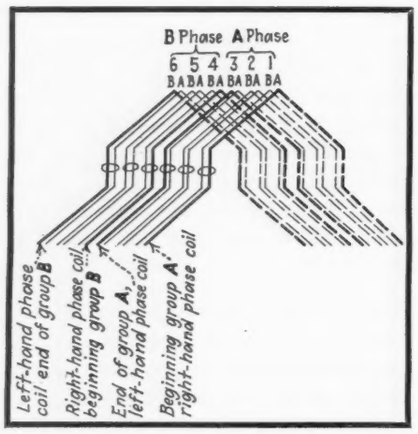

B Phase A Phase
6 5 4 3 2 1
B A B A B A B A B A B A
Left-hand phase coil end of group B
Right-hand phase coil beginning group B
End of group A, left-hand phase coil
Beginning group A, right-hand phase coil

Figure 1. How right- and left-hand phase coils are arranged in a winding having three slots per pole per phase, four conductors per slot

IN JULY the use of the checking charts presented in these articles was described for locating the line leads in a.c. wave windings having 2½ slots per pole per phase. The present article will discuss the use of the checking chart, with the connecting diagram and connecting table, for windings having three slots per pole per phase.

The checking charts in these articles are all laid out with the slots and pole-phase groups in the same order and sequence as they are in the actual winding; hence they can be used to check the coil grouping; to locate the slots in which the coils with extra insulation on the ends (phase coils) are placed; and also to locate the slots in which to place the short-lead coils for the short-pitch (SP) connections.

Coil grouping with an even number of slots, as 2, 3, 4, and so on, is always equal, as Checking Chart III for three slots per pole per phase shows. For 2½, 3½, and so on slots per pole per phase, as in Checking Chart II, July issue, the grouping is odd, and the chart shows this fact by the number of slots in each pole-phase group. Note that a space (. . .) is used to indicate the pole-phase groups having one slot less.

In some windings the coils that are at the beginning and end of each pole-phase group are reinforced with additional insulation. These coils are termed phase coils, and their proper location in the winding is important.

The checking charts have a black dot over each slot number that should have a phase coil. When there are more than two conductors per slot the conductors at the beginning and end of each group of conductors at the beginning and end of each pole-phase group are reinforced, or made the phase conductors of the phase coil.

For example in Checking Chart III, with the 4-pole, 36-slot winding, slots *1* and *2*, *4* and *5*, *7* and *8*, *10* and *11*, *13* and *14*, *16* and *17*, *19* and *20*, *22* and *23*, *25* and *26*, *28* and *29*, *31* and *32*, *34* and *35*, are phase-coil slots. They can be considered as bottom coil slots, since the proper placing of the phase insulation in any slot group of conductors will be correct for the top and bottom leads.

For Fractional Numbers of Slots

On the other hand, it will be recalled that in Checking Chart II for 2½ slots per pole per phase, the 4-pole, 30-slot winding has phase coils in slots *1* and *2*, *3* and *4*, *6* and *7*, *8* and *9*, *11* and *12*, *13* and *14*, *16* and *17*, *18* and *19*, *21* and *22*, *23* and *24*, *26* and *27*, *28* and *29*. Therefore, for 2½, 3½, 4½, and so on slots per pole per phase the checking charts have a dot over slot numbers in the

Checking Chart III*

Three Slots per Pole per Phase

No. of Slots	No. of Poles	Polarity	Phases								
			●	C	●	●	B	●	●	A	●
		↑	7	6	5	4	3	2	1	Y	X
36	4	↓	16	15	14	13	12	11	10	9	8
		↑	25	24	23	22	21	20	19	18	17
		↓	34	33	32	31	30	29	28	27	26
54	6	↑	43	42	41	40	39	38	37	36	35
		↓	52	51	50	49	48	47	46	45	44
72	8	↑	61	60	59	58	57	56	55	54	53
		↓	70	69	68	67	66	65	64	63	62
90	10	↑	79	78	77	76	75	74	73	72	71
		↓	88	87	86	85	84	83	82	81	80
108	12	↑	97	96	95	94	93	92	91	90	89
		↓	106	105	104	103	102	101	100	99	98
126	14	↑	115	114	113	112	111	110	109	108	107
		↓	124	123	122	121	120	119	118	117	116
144	16	↑	133	132	131	130	129	128	127	126	125
		↓	142	141	140	139	138	137	136	135	134
162	18	↑	151	150	149	148	147	146	145	144	143
		↓	160	159	158	157	156	155	154	153	152
180	20	↑	169	168	167	166	165	164	163	162	161
		↓	178	177	176	175	174	173	172	171	170
198	22	↑	187	186	185	184	183	182	181	180	179
		↓	196	195	194	193	192	191	190	189	188
216	24	↑	205	204	203	202	201	200	199	198	197
		↓	214	213	212	211	210	209	208	207	206

*To be used with Figure 3 and Connecting Table III.
●Indicates slots for phase coils.

Connecting Table III*

Three Slots per Pole per Phase

No. of Poles	No. of Slots	A Phase Bottom A1	A Phase Leads A*	A Phase Top A3	A Phase Leads A4	B Phase Bottom B1	B Phase Leads B*	B Phase Top B3	B Phase Leads B4	C Phase Bottom C1	C Phase Leads C*	C Phase Top C3	C Phase Leads C4	Short Pitch Connections SP 1–3–5	Short Pitch Connections SP 2–4–6
4	36	↑ 1	28	26	17	↓ 13	4	2	29	↑ 25	16	14	5	2	2
6	54	↑ 1	46	44	35	↓ 13	4	2	47	↑ 25	16	14	5	2	2
8	72	↑ 1	64	62	53	↓ 49	40	38	29	↑ 25	16	14	5	2	2
10	90	↑ 1	82	80	71	↓ 31	22	20	11	↑ 61	52	50	41	2	2
12	108	↑ 1	100	98	89	↓ 31	22	20	11	↑ 61	52	50	41	2	2
14	126	↑ 1	118	116	107	↓ 85	76	74	65	↑ 43	34	32	23	2	2
16	144	↑ 1	136	134	125	↓ 49	40	38	29	↑ 97	88	86	77	2	2
18	162	↑ 1	154	152	143	↓ 67	58	56	47	↑ 115	106	104	95	2	2
20	180	↑ 1	172	170	161	↓ 121	112	110	101	↑ 61	52	50	41	2	2
22	198	↑ 1	190	188	179	↓ 67	58	56	47	↑ 133	124	122	113	2	2
24	216	↑ 1	208	206	197	↓ 139	130	128	119	↑ 61	52	50	41	2	2

*See Figure 3 for connecting layout

Back pitch and front pitch = 1 and 10. Short pitch = 1 and 9

pole-phase groups having one less coil, in addition to the dot at the head of the columns in which all slots are phase-coil slots.

As mentioned previously, all of the connecting diagrams indicate by the use of heavy lines the proper location of phase coils. In Figure 3, the first and last coil of each pole-phase group of three coils is shown with a heavy or wide line to indicate where phase insulation is required.

Arrangement of Phase Coils

Where phase insulation is used on windings having four or more conductors per slot the matter of phase coils becomes more complicated because right- and left-hand phase coils are introduced and their correct placing in the winding is important.

The proper arrangement of right- and left-hand phase coils is shown in Figure 1, which shows a portion of a winding having three coils per group, or three slots per pole per phase, and four conductors per slot. At the rear end the straps or conductors are marked *A* and *B*, and the complete coils, containing two conductors, are marked, *1, 2, 3,* and so on. Pole-phase group *A* starts on conductor *A* in coil or slot *1*, and ends on conductor *B* in coil or slot *3*. Both of these conductors are shown in Figure 1 to have phase insulation; since conductor *A* of coil *1* is the right-hand strap and is reinforced with extra insulation, coil *1* is called a right-hand phase coil.

In the same diagram strap *B* of coil *3* has extra insulation since it is the end of pole-phase group *A* and

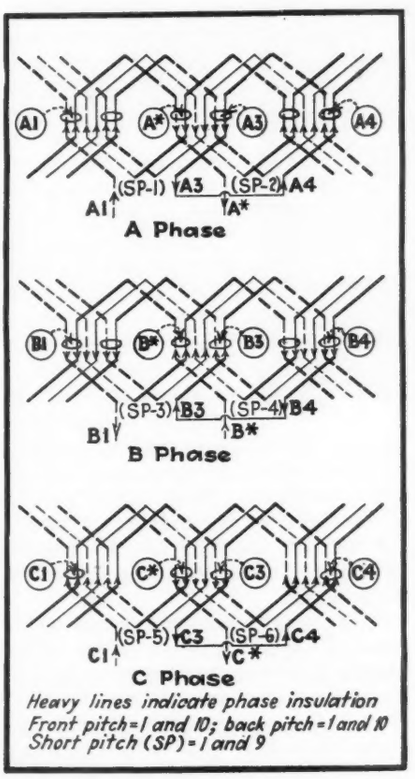


Figure 3. Connecting diagrams for a.c. wave windings having three slots per pole per phase. This diagram is to be used with Connecting Table III

is, therefore, a left-hand phase coil. The next adjacent pole-phase group, *B*, starts on conductor *A* of coil *4;* hence coil *4* is a right-hand phase coil. Right- and left-hand phase coils must be placed as shown in Figure 1 for proper phase-group insulation.

When used in any winding phase coils can be identified in most cases by extra insulation on the ends, making the coil thicker on the end sections. In some cases an identifying number is stamped on the lead end of the strap, a different number being used for the right- and left-hand coils. The remainder of the coils are termed plain coils, and are all insulated alike.

The total number of phase coils in any three-phase wave winding is always equal to six times the number of poles, or twice the number of pole-phase groups. Then, with four or more conductors per slot, the total number of phase coils will be divided half into right- and half into left-hand phase coils.

Different Types of Phase Coils

There may be two or three different types of coils in a winding, that differ only in the amount or kind of their insulation. This point should be checked in every winding so that the phase coils can be separated into the proper number of groups.

On large windings using conductors of heavy strap, the phase coil problem is more complicated, since at six points in the winding the short-pitch (SP) connections require coils having the top lead short, and others with the bottom lead short.

In consequence there will be short-bottom-lead, right-hand phase coils, short-bottom-lead, left-hand phase coils, short-top-lead, right-hand phase coils and short-top-lead, left-hand phase coils, in addition to the standard-length-lead, right- and half-hand phase coils, making six groups of phase coils. There will always be six phase coils of each short-lead type.

The next article will discuss the winding pitch and show the location of phase and plain, short-lead coils.

OPERATING SHORTS

Freight Car Loaded in 20 Minutes

E. L. JORGENSEN
Plant Superintendent
Irvington Smelting & Refining Co.
Irvington, N. J.

It was taking seven or eight men an hour or more to load a car with barrels of copper sulphate. This time seemed excessive, so, to reduce the shipping cost, an automatic loading arrangement was designed.

A portable elevator was obtained and provided with a tilting platform. It was placed by the door, and an inclined runway was built from the door to the siding. Now, a barrel is placed on the platform and the starting button pressed. As the platform nears the level of the runway, a chain and spring secured to the frame tilt it. When the platform has tilted sufficiently to make the barrel roll off, it touches a limit switch which automatically stops the elevator at the runway level.

The barrel as it starts down the runway, rolls over another switch which starts the platform down again. When it reaches the floor another barrel is rolled on, and the starting button is pressed to repeat the procedure. Thus carloading is a continuous performance. With one man at the elevator and another in the car, the car can be loaded in 20 minutes.

The installation was made at a cost of approximately $700. The saving per year is around $1,200.

Mr. Jorgensen's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

Aged Workers Stay on Payroll

SOURCE, *York Ice Machinery Corporation, York, Pa.*

Aged workers who can no longer hold their places in the production line, and to whom retirement would mean complete inactivity and certain decline, we place in what we call our Specialty Department. Here in a quiet, isolated workroom, stripped of hazardous machinery and equipped with cushioned stools at long wooden benches, the 70-year-olds can perform light assembly tasks, file burrs off castings, or make small fittings.

Punching no time clocks, they come and go as they please, work as little as they want to. What they earn is entirely up to them. They are paid hourly rates that are relatively small but commensurate with the work they do.

When a man reaches the point where he is of no further use in the production line, he is simply told that he is to be transferred to another department. The realization that he is being removed from the main show comes without shock, and he continues in work that demands no sacrifice of his self-respect.

The average age of the group in this department is over 76 years, and all members of the group are members of the company's 25-year club. All of these old workers are kept on the payroll list, regardless of business depressions or their ability to work.

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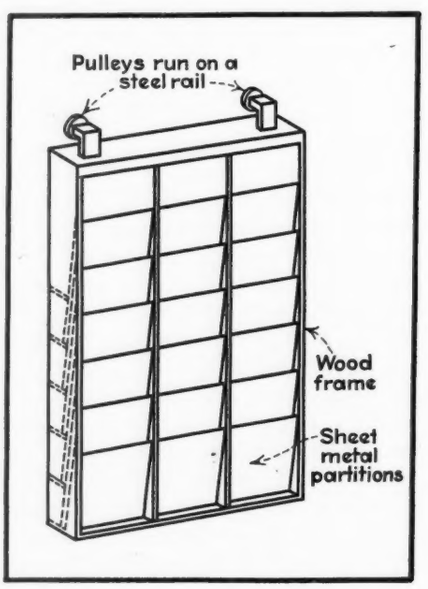
A Perpetual Calendar Bulletin Board

WALTER C. BACHMAN, *Bethlehem, Pa.*

A perpetual calendar bulletin board suitable for scheduling over comparatively long periods is composed of units similar to the one shown in the accompanying sketch. Each unit contains three columns of small cells four inches wide. Each cell represents a day and each column a week. Sections containing three columns are constructed as single units and suspended by two pulleys from a steel rail fastened to the wall. When each section becomes out of date it is emptied and moved to the other end of the rail. The pulleys permit the other sections to be easily pushed to their new positions. If the frame is constructed of stained wood and the vertical cell divisions are made of thin polished sheet metal, the result may be very attractive.



Special forms printed on thin cardboard folders are used to record information of scheduled events. They fit loosely in the cells and may

be distributed, filed or destroyed as they become due.

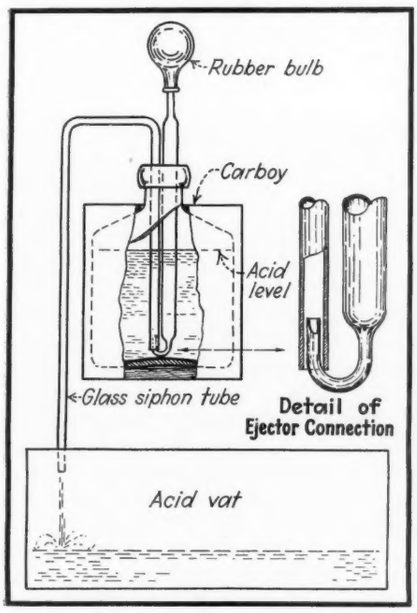
Ten units such as have been described permit scheduling seven months in advance and require about twelve feet of wall space for the present installation. Schedules posted on a bulletin board of this type are readily accessible to many people, are easily kept up to date, and provide a maximum of flexibility.

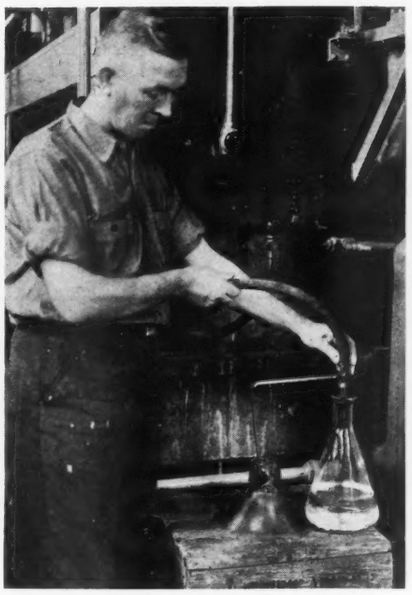
List of inactive and surplus materials, prepared in alphabetical and numerical order and distributed to all storekeepers, purchasing agents, manufacturing and service departments, has kept much material and equipment from the scrap pile for one large concern.

Two Siphons for Safe Acid Handling

SOURCE, *Westinghouse Lamp Company Bloomfield, N. J.*

Ten-gallon carboys of hydrochloric, nitric, and sulphuric acid have always been dangerous to handle. The danger, though there be no serious accidents from this source in a plant's history, is always great enough to warrant rigid safety measures. Two new methods of handling acids have been adopted at our plant, which are expected to minimize the risk in this work. One method is designed for the ejection of small quantities from carboys; the other provides a means of emptying carboys into acid vats without





splashing the acid. Splashing acid is always a hazard.

Acid was formerly ejected by applying a few pounds air pressure to the carboy, forcing a flow of acid into filter flasks. The chance of breaking the carboy seemed remote, but one eventually did break with serious consequences to the worker. Now a simple suction device is employed to draw small quantities of acid from a carboy for use in processing lamp filaments. A filter flask is plugged with a rubber stopper and two glass tubes. One tube drops down into the carboy; the other is connected to a rubber suction hose. Air is withdrawn from the flask, creating a suction that draws acid up from the carboy.

An interesting feature of this ejector device is the method of creating suction. The rubber hose is attached to the suction side of a laboratory water filter, and as air is released from the pressure line through the nozzle of the water filter, it creates suction in the hose. This suction, though slight, is sufficient to create enough vacuum in the filter flask to draw acid from the carboy.

A different siphoning arrangement is employed to empty a full carboy into an acid vat. The carboy bottle is plugged with a stopper and two glass tubes which extend to the bottom of the carboy. One tube is a siphon that runs out, over, and down into the vat below. The other tube parallels the first and connects with it at the bottom of the bottle. Outside it is topped by a rubber bulb. Pressing the bulb forces acid up into the siphon tube until it spills over and starts a flow down into the vat below.

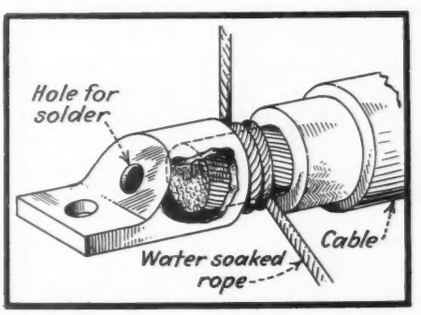
Hole in Terminal Lug Facilitates Soldering

J. E. WRIGHT, *Montreal, Que., Canada*

In most cases it is not difficult to connect cables to switches and solder the lug terminals satisfactorily, since the cable is vertical and the lug inverted, so that it retains the solder. There are times, however, when the cable runs have to be brought up through the floor and short lengths must be handled, with the result that the cable has to be bent to and fro in order to obtain the proper curvature to sweat the lug onto it.

This movement tends to weaken the insulation and fray the outside braiding. I have seen a cable bent by passing a pipe over it, using a piece of timber as a fulcrum.

To facilitate matters in such a case I drill a hole in the curved or bottom end of the lug, place the lug on the upright cable, and wrap a small rope that has previously been soaked in water around the cable and up tight against the lug. The



wet rope helps to chill the hot solder at the edge of the lug when poured from a ladle, and also prevents the rope from burning when a torch is used to run stick solder.

Sane Sayings on Safety

R. A. SHAW, *Safety Engineer*
The Murray Corporation of America
Detroit

When a factory increases its working personnel 25 per cent and establishes a new low accident rate, there must be a reason; safety methods in vogue must be effective.

When a manager or superintendent says, "We are too busy to hold a safety meeting as scheduled due to pressure of production," look out; something is wrong; danger is near.

Why blame the inexperienced youth after an accident? Instead, find out who failed to impress upon this young fellow the importance of caution. Telling doesn't always suf-

fice, but demonstrations are convincing.

When so many inspectors are needed to check failure in production methods, why isn't it logical to have someone check human failures that are made possible by unsafe practices. If such precautions are taken, savings greater than the cost of maintaining the safety checkers will result. And humanitarian advantages, which are impossible to measure in dollars and cents, are added.

Cash awards for meritorious suggestions from employees and a cash bonus for every fifth suggestion from the same individual, showing possibilities of savings in manufacturing process, materials, and tool expense, proved to be a money-saving scheme.

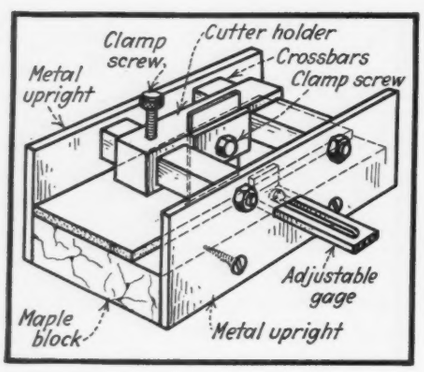
To Cut Down Belt Width, a Handy Cutter

JOHN A. HONEGGER, *New York*

It is often necessary for the maintenance man to reduce the width of a belt. To cut a belt of any length, so that the sides are reasonably parallel, is hard to do unless some kind of cutting fixture is employed.

The fixture shown is inexpensive to construct, yet it will do the job well. It consists of a maple block to which is fastened on each side a metal upright. Two crossbars are fastened to these side plates, and upon these bars slides the cutter holder. This holder has a recess in which a blade is clamped; it is adjustable so that a belt of any width can be cut. A clamp screw is used to clamp the holder in place, and an adjustable gage guides the belt while it is being cut.

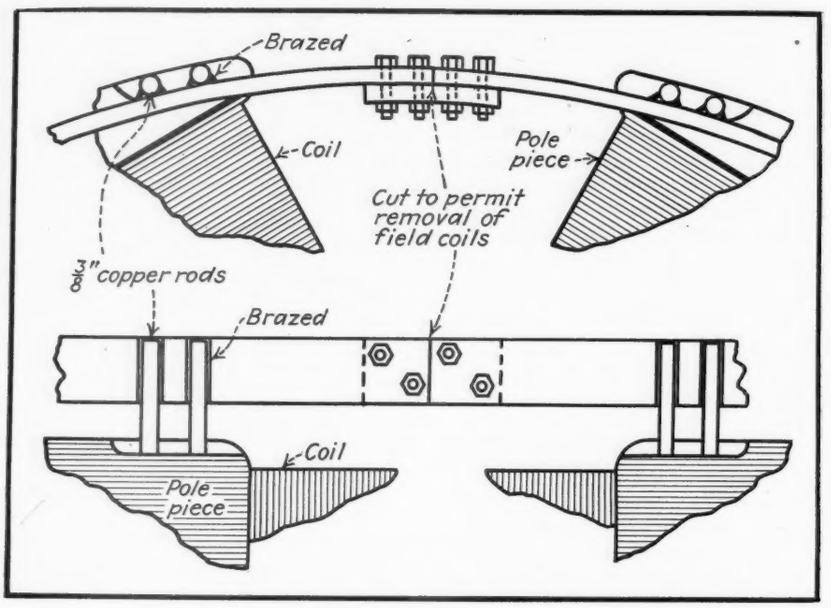
In use, the fixture is placed in a bench vise so that it is rigidly held as the belt is pulled through.



From Alternator to Synchronous Motor

L. A. HUNT, *Toronto, Ont., Canada*

In a Western lumber mill a synchronous motor was needed to drive a blower, and it was decided to use an idle 37½-kva. alternator. However, there was no squirrel-cage or amortisseur winding on the rotor; so when used as a motor the alternator would not have started the fan when the stator was energized. It was also feared that there might be some trouble from hunting.



The rotor was of the salient-pole type with sufficient metal in the pole shoe to allow a ⅜-in. hole to be drilled through the shoe parallel with the shaft; so it was decided to drill four holes in each pole shoe and insert ⅜-in. copper bars to serve as a squirrel-cage winding. The pole pieces were dovetailed to the rotor hub and also held by end clamping plates that were shrunk on. Since considerable labor would be involved in removing the pole pieces, the complete rotor was mounted on a drill press whose table was blocked up for the purpose.

Long, high-speed drills were made by welding steel rod to standard drills. The rotor was accurately spotted for each hole.

To prevent the drill from emerging suddenly in the wrong location, and possibly damaging a coil, the mechanic placed his finger under the pole shoe when the hole was about through. The hot spot indicated the location of the drill point, and when to ease up.

After the bars of ⅜-in. round, hard-drawn copper were all in place, a length of 1x¼-in. busbar copper was formed into a circle by hammering it around a pulley so that it would fit inside the copper bars like the end rings on a rotor, and the bars were welded to it. The ring was then cut between poles and joints were made by lapping and bolting copper straps over each cut. This was done to permit removing a field coil, if necessary. The rotor was then balanced and, after it had been installed, operated satisfactorily.

In a job of this kind one of the questions that comes up concerns the number and size of bars in the squirrel-cage winding. Normally such windings are designed so that the number of conductors is approximately five-sixths of the number of stator slots. The cross-sectional area of the conductors is such that the current density will be from 2,000 to 3,000 amperes per square inch. This high density is permissible, since there is no insulation to hinder heat radiation, which is also aided by the fan action of the rotor.

With this alternator the greatest number of bars that each pole shoe could satisfactorily accommodate was four, and the thickness of the shoe limited the cross-sectional area to ⅜ in.

The conductors must also be so spaced that they do not form a locking point with the stator. To determine the proper spacing, assume a complete squirrel-cage winding with the bars so spaced that their number is prime to the number of stator slots (that is, the two quantities

have no common divisor except 1) and drill the pole shoes for this spacing.

When a squirrel-cage winding is used only to prevent hunting, the number of conductors should be common to the number of stator slots. Then the pitch of the rotor bars would match that of the stator slots, perhaps a bar every second or third slot, which would minimize the current in the squirrel-cage winding.

Discarded leather belting isn't necessarily junk, may have a high salvage value. Example: a belting manufacturer recently worked over 502 lb. of old belting for a customer. As received, it was worth 5 cents a pound—$25.10 altogether. Reconditioned, it was valued at $256.45. Cost of doing the work was a small percentage of the increase in value.

Find Blown Fuses Easily with Tagged Circuits

ALLAN B. MORTON, *Office Manager*
I. F. Laucks, Incorporated
Portsmouth, Va.

We purchased a large one-story building formerly used as a table factory, and found nearly two hundred outlets, light sockets, and small motor circuits already installed. As the wiring seemed to be in good condition, practically all of it was left intact. In addition, we installed some new wire for heavy motors and special circuits, in many cases paralleling the old circuits. It was not long before we began to run into difficulties in determining in which of the many fuse boxes a blown fuse was located.

We finally hit upon the idea of using aluminum leg bands, such as are used for marking chickens, in marking these circuits. Of course, these bands come in sets of consecutive numbers, so we had to buy quite a number of sets in order to secure enough of one number to mark all the ten or twelve drop cords that were contained in some circuits. These bands were long enough to lap around a one-half inch conduit, BX, or drop cord. The stamped number corresponded to a fuse number painted on the inside cover of the fuse box. In some cases steel dies were used to stamp numbers on outlet covers.

Lunches That Workers Can Afford

SOURCE, *Packard Motor Car Company Detroit*

A variation on the usual plant lunchroom idea is being tried out experimentally at this plant. It is intended to meet the needs and desires of the largest proportion of the employees—something which the old-time types have increasingly failed to do during depression times.

Instead of a cafeteria selling entire meals—inevitably at a sizeable loss to the employer and at a set of prices higher than most workmen can today afford—or else providing no facilities for eating, there are plant lunchrooms of minimum type. The service counter is comparatively short, just long enough for selling the only merchandise in which these lunchrooms deal: beverages; and box lunches.

Bare tables, with benches, in large, clean, and well lighted rooms, provide a place for eating, and of a type which permits complete cleaning after meals at minimum expense. Employees are expected to leave milk bottles, coffee mugs, and so forth, on the tables, whence they are cleared by the sweepers after factory work is resumed.

The method has the indicated advantages over full-fledged cafeterias for workers who want to keep the cost of their noon meal down. It has two major advantages over making no provision for eating: (1) Employees have better rounded meals, and eat them in comfortable—if not luxurious—surroundings; (2) Since practically nobody eats in manufacturing departments, the problem of food scraps has been pretty well avoided.

SPECIAL NOTICE

$10 will be paid for the best Operating Short submitted during the month of October. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

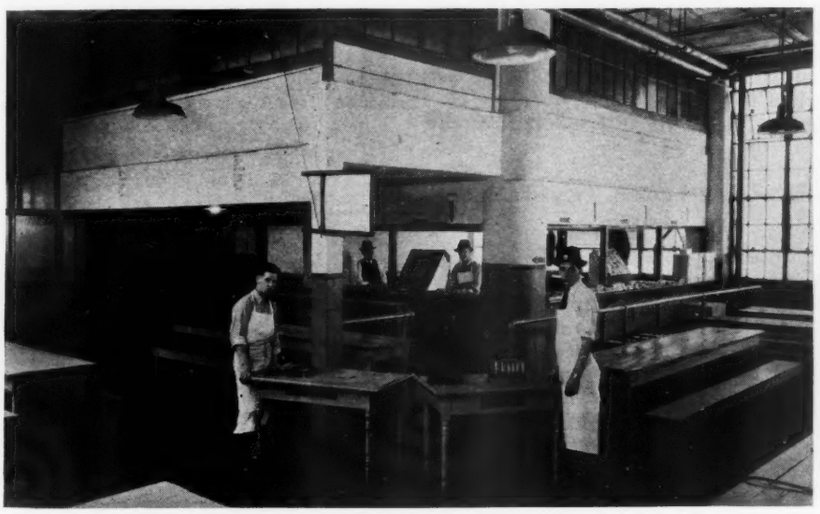
To salvage metal turnings at low cost keep scrap separated by using shallow pans which can be placed under cutting tools and easily changed when work is started on new kind of metal.

Removing Broken Stud by Welding

SOURCE, *Air Reduction Sales Company, New York*

A stud had broken off slightly below the surface of a cylinder block. A screw-type stud remover had been tried, and had broken off in the stud. This left it so that the stud could not be drilled out.

But the fellow who had to remove that stud wasn't stumped. He took a washer with a hole about the size of the stud and placed it on the block over the stud. Then with an arc welder he built the stud up and welded it to the washer. On top of the washer he welded a nut. Cold water poured on the nut to cool it also helped shrink the stud. Nothing left to do but take a wrench and turn out the stud.



Questions *and* Answers

Conducted by G. A. VAN BRUNT

Answers Wanted

Synchronous Condenser Fails to Attain Speed

We have been having trouble with the synchronous motor of an m.g. set that consists of the motor, a 200-kw. d.c. generator, and a 30-kw. exciter, all on the same base. The synchronous motor is rated 345 hp., 0.8 power factor, 440 volts, 1,200 r.p.m., three-phase, 60 cycles. The field is wound for 250 volts, 11.9 amp. Control equipment includes a double-throw oil circuit breaker with short-circuiting contacts that close the Y-connection in the autotransformer; motor field rheostat; discharge resistor; line and field ammeters; overload and undervoltage protection; exciter field rheostat. We disconnected the generator at the coupling and have been using the motor as a condenser for power factor correction. The condenser is started with all field resistance in until it reaches synchronous speed; then field is applied and the autotransformer disconnected by the double-throw breaker. After this the condenser is thrown on the line and the field adjusted.

Two years after this set was installed, in 1928, the condenser would not come up to synchronous speed. The autotransformer was put on the second tap and there was no further trouble until 1932, when the same trouble appeared. It was solved by starting the machine on the third tap. Later the insulation between the field coils broke down near the core. The machine was repaired and operated normally for a time, but now we are unable to get more than 50 per cent of synchronous speed on starting. Where is the trouble most likely to be? How can I locate it?

G.H.H.—Everett, Wash.

Motors Sometimes Fail to Start

A number of our motors, 5-10 hp., three-phase, 440 volts, 60 cycles, are controlled by Start and Stop buttons. In several instances there are two pushbutton stations for a motor, so that it can be started or stopped from two different locations that are at a considerable distance from the motor and from each other. From time to time we have trouble in starting a motor. When one of the Start buttons is pushed, either nothing happens or the motor starts up and immediately stops. If the other Start button is pushed the motor usually will start and run normally. It has been reported that on two occasions a motor failed to stop when the Stop button was pushed. Could this be possible? What causes this trouble in starting and, possibly, stopping our motors? The motors, switches, and buttons seem to be in good condition.

J.F.—Cleveland

Bright Dip for Copper and Brass

I wish that some reader would give me the formula for a pickle that will put a bright finish on copper and brass parts. A considerable part of our work is on switchboards used on boats. Frequently the switches, fuse clips, and other parts are badly corroded and it is necessary to clean them thoroughly.

F.W.—Seattle

A SOLUTION commonly employed as a bright dip for brass parts can be made by mixing,

2 parts sulphuric acid
1 part nitric acid
5 parts water

Always stir the acid into the water. Immerse the parts to be cleaned in this solution for a few moments; then rinse in cold water. If all of the corrosion is not cleaned off, immerse again and rinse in hot water. If necessary, repeat this process until the parts are bright and clean.

RAYMOND O. KRENGEL, *Chicago*

How Determine Transformer Losses?

What is a simple and accurate way of determining the over-all losses in a bank of three 333-kva., single-phase transformers, rated 4,600/440 volts? These transformers supply power and light and when the plant is operating they are loaded fairly close to capacity, but on weekends and holidays they carry only a small lighting load. I want to find out whether the losses at these periods of light load are sufficient to warrant installation of a small transformer to supply the lighting load and permit the large transformers to be cut off. Any suggestions will be appreciated.

G.J.—Minneapolis

ASIDE from actual measurement, the simplest and most accurate way of ascertaining the losses in a bank of transformers is to secure these data from the manufacturer.

The total losses times the power rate times the number of hours that the transformers are on the line when the plant is not operating will give the cost of power consumed, or wasted, during these periods.

Undoubtedly the questioner will find that it is cheaper to install a small transformer to carry the lighting load during periods when the plant is not in operation. A. G. VIOLA, *St. Louis, Mo.*

EXACT figures can not be guaranteed for all transformer losses. The iron loss is constant at all loads, whereas the copper loss varies as the square of the current. The manufacturer usually gives the iron loss in watts in table form for the various types of transformers.

The iron loss test should be taken at rated voltage on the low-voltage side of the transformer. The primary or high-voltage side should be short-circuited. Equipment necessary is an ammeter, voltmeter, wattmeter, and means of regulating the voltage.

Copper loss is an energy loss and comprises the I^2R loss caused by the load currents, and eddy current loss due to circulating currents. Either the primary (high-voltage) or the secondary winding may be used as the primary; the other winding is then short-circuited. Adjust the applied current to the rated transformer current. An ammeter, wattmeter, and means of regulation are necessary. The copper loss obtained should be corrected

(Continued on advertising page 84)

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What are your most troublesome problems? Free-for-all discussion of them will help you and other readers

EQUIPMENT NEWS

Truck

For moving machinery and general millwright use. Has double-drum, motor-driven winch mounted above battery compartment. Cable sheaves provide for convenient handling of any type of equipment to be moved. Capacity of 6,000 lb. and high lift. Equipped with 4-wheel trailing axle, vertical-wheel steering, winch motor controller, and ampere-hour meter. Hydraulic lift, double-reduction bevel- and spur-gear drive axle, magnetic contactor control, ball bearings, safety brakes, semi-elliptic spring suspension, automatic overload protection. Mercury Mfg. Co., 4100 S. Halsted St., Chicago.

Paint

For protection of ferrous-metal surfaces that have already rusted. Paint is applied over the rust which becomes a part of the protective coating. Coating may serve as priming or finishing coat. Manufacturer claims that weathering improves quality of the paint and that coating will resist all destructive action of acids, alkalis, and weather. The Harrington Paint Co., Inc., 1630 Collamer Ave., East Cleveland.

Welding Rod

Stainless steel for welding 18-8 chrome-nickel steels. Contains columbium. Improves corrosion-resistance of fabricated joint areas. Known as Oxweld No. 28 Columbium-Treated 18-8 Welding Rod. The Linde Air Products Co., 205 E. 42d St., New York.

Stainless Steel

Bar stock. For use where surface of bar must have corrosion- and temperature-resistant properties. Web-like structure holding low carbon inserts to extent of 40 per cent. Cladding can be varied 10-25 per cent depending upon application. Made in rounds, flats, octagons, hexagons, sheets, strips, and special shapes. Called "Silverbond." Jessop Steel Co., Washington, Pa.

Goggle

Chipping. Weighs 2½ oz. Large 50 mm. lenses and shallow eye cups. Air circulation to keep eyes cool. Chicago Eye Shield Co., 2331 Warren Blvd., Chicago.

Airbrush

Adjustable fluid lock. Fluid can be fed from above or below gun. Air line can be attached at rear or bottom of handle. Manufacturer claims that gun has great speed, is damage-proof, that air pressure can be fixed for any specific finish. Known as Convertible High Production Airbrush. Paasche Airbrush Co., 1909-27 Diversey Parkway, Chicago.

Switches

Line of group-operated, 3-pole, indoor disconnecting switches with tongue-type contacts. Double blades and operating mechanism that can be locked in either open or closed position. Straight-, front-, or back-connected insulators, or various combinations. Steel base arranged for flat or pipe mounting. Connecting rod between switch mechanism and operating handle can be any desired length. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

Wrench

Pipe. Made of heat-treated, drop forged steel with housing forged integral with handle. Renewable lower jaw of hardened steel has cross tongues seating into cross slots in handle, and is locked in place to eliminate backward shear on pin. Replaceable spring. Ten-inch size has larger capacity than earlier models. Rust-proof finish. Cadmium-plated nut. Walworth Co., 60 W. 42d St., New York.

Circuit Breaker

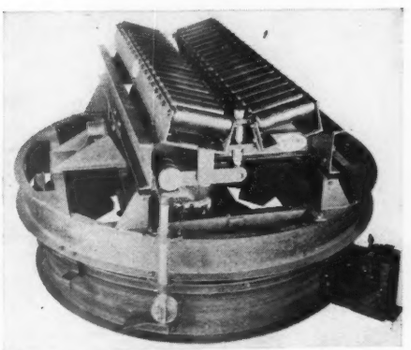
Has swing-out interior. Breaker is mounted on metal pan which is hinged to box. Swing-out makes possible bringing in of conduit and wires without obstruction. Open space between back of box and interior gives plenty of room for wires so that insulation is not damaged. Operating handle permanently engaged with breaker handle. Available in 2- and 3-pole designs with ratings from 15-50 amp., 250 and 575 volts a.c., 125 and 250 volts d.c. Square D Co., Detroit.

Compressors

Two-stage, air-cooled. Air-cooled intercooler. Force-feed lubrication. Full floating piston pins. Motor- or belt-driven. Capacities 85-323 cu.ft. per min. Chicago Pneumatic Tool Co., 6 E. 44th St., New York.

Turntable

For receiving 6-ton coils of strip steel from straight conveyor and revolving them into position for pickling.



Driven by 5-hp., 1,200-r.p.m., 3-phase, 60-cycle, 220-volt motor. Trough shaped conveyor section. Rollers are 3⅜ in. in diameter with load ratings of 2,000 lb. per roller. Ball-bearing, grease-packed type with grease fittings for periodical lubrication. Mathews Conveyer Co., Ellwood City, Pa.

Starter

Across-the-line type for general purpose installations. Rated 25 hp. at 440 and 550 volts, 15 and 7½ hp. at 110 volts, and furnished for pushbutton control. Temperature-overload relay designed on melting-alloy principle. Heavy silver contacts, vertical make-and-break, short stroke mechanism, and multi-break arc prevention principle. Pressed steel case equipped with knockouts for conduit connections. Type A-32. Condit Electrical Mfg. Corp., Boston.

Blast Cleaning Machine

Called "Rotoblast." Rotor operating at 2,450 r.p.m. throws abrasive by centrifugal force against metal being cleaned. Rotor is steel disk 20 in. in diameter and 1 in. thick, revolving on steel spindle. Wear face of rotor covered by half-inch-thick steel plates whose radial joints are recessed to form four tapered grooves. Edges of four

heavy blades fit into grooves; blades carry abrasive to throwing point. Impeller of one-piece construction with four agitating fins feeding abrasive to rotor blades. Manufacturer claims that all parts coming into contact with abrasive are of tough cast metal. Pangborn Corp., Hagerstown, Md.

Testing Machine

Direct-reading Brinell machine for hardness testing. Testing done on rough surface without spotting. Tolerance hands on face of indicating dial are set to desired limits by using

microscope. Operator has merely to note whether pointer stops between hands. Foot pedal. Tests can be made on all shapes. Frame cast in one piece. Pump gears hardened and ground, and gear shafts ball-bearing mounted. Two sizes, one with work-gap 6x12 in., other with work-gap 9x18 in. Available also without direct-reading feature for those requiring plain motor-driven Brinell. Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit.

Resistors

For large a.c. wound-rotor motors of more than 100 hp. All resistor grid boxes mounted in fan-cooled, sheet-metal cabinet with terminal board on outside. Manufacturer claims savings in space requirements. Grid boxes wired at factory to provide motor speed characteristics desired. General Electric Co., Schenectady, N. Y.

Orifice

Adjustable. For use with recording and integrating fluid meter, widening flow range that may be covered. Automatically shifts position in accordance with major changes in rate of flow. Movable stops limit stroke of hydraulic piston so that orifice segment rests in either one of two definite positions. Piston actuated by solenoid-operated valve which is commanded by contactor in meter. When orifice changes, integrator drive is shifted to a second motor. Contactor also energizes small solenoid that operates auxiliary recording pen to show multiplying factor. Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland.

Tool Cart

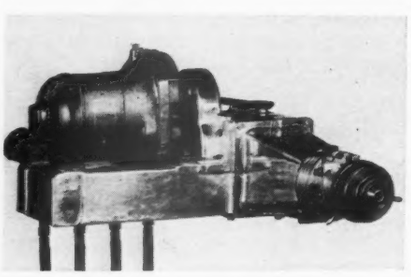
Three-decked, portable stand for holding and transporting tools and parts. Two open trays, one drawer, and one compartment opened by lifting top. Mounted on 2½-in. casters. Dimensions: 34½ in. high, 18 in. wide, 24 in. deep. Heavy gage, rolled steel. Called "Tool Toter." Lyon Metal Products, Inc., Aurora, Ill.

Steel Tubing

Stainless. Thin wall, with or without carbon inserts. Made in outside diameters of ⅝, ¾, ⅞, 1, 1¼, 1½, and 1.9 in. Also some square and rectangular shapes. Known as Allegheny Metal Architectural Tubing. Allegheny Steel Co., Brackenridge, Pa.

Metal Sprayer

Called "Gillord Process." Deposits 11-35 pounds of metal per hour, depending on melting point of metal used. Metal fed into tool in form of No. 9 wire and melted in oxyacetylene flame in melting chamber within head of tool. Air, neutralized by gas to prevent oxidation of atomized metal, carries metal to area of deposit, and keeps tool cool. All gases and air are handled through metering jets set at the factory. If proper pressure is maintained on supply lines, the tool controls the mix, and



the operator has only to light tool and shut it off. Wire-feed is adjustable and driven by 1/6-hp. motor through reduction-gear unit. Can be used to replace worn metal on shafts, wrist pins, plungers, and the like; for coating rolls and tanks with stainless steel or other noncorrosive metals; for the making of dies by spraying. May be mounted in lathepost or on holding fixtures. Gillord Sales Corp., 420 Lexington Ave., New York.

Lifting Device

Called "Grip Lifter." For handling steel plates, columns, piling, and so on. Attached to crane or hoist by cable

connection through eye. Pull-lever opens jaws. When lever is released load is held until lever is again pulled down. Two sizes: ⅝-in. throat capacity for 5-ton load, 1½-in. capacity for 10-ton load. Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich.

Belting

Made by continuous vulcanization process. Manufacturer claims uniform stretch, high and uniform quality, and high friction coefficient. Two types. "Bull Dog" for hard drives and severe service. "Perfection" for high speeds on small pulleys. Boston Woven Hose & Rubber Co., Cambridge, Mass.

Welders

For spot welding. Welding switch operated by pedal. Switch and all line parts completely inclosed. Flexible stranded conductor allows free movement of welder arm. Cast-copper electrode holders. May be mounted on bench or supplied with stand. Two models, both for 60-cycle operation. No. 40 has 1.5 kva. rating, may be used on 110- or 220-volt lines. No. 50 has 2.5 kva. rating, for use on 220 volts. Dimensions of No. 40 are 9½x5x16 in.; No. 50 is one inch wider. Called "Ace Spot Welders." Pier Equipment Mfg. Co., Benton Harbor, Mich.

Strapping Reel

Coil-control holds strapping tight on reel. All-steel and tube construction. Three combinations: No. 10 includes stand for scales, tools, and small shipping units and wheels for portability; No. 9 has no stand; No. 8 has neither stand nor wheels. Signode Steel Strapping Co., Chicago.

Alloy

Electrical resistance. For electric furnaces and heaters. Manufacturer claims for it oxidation-resisting qualities. Three grades with maximum temperature around 2,460 deg. F. Called "Kanthal." The C. O. Jelliff Mfg. Corp., Southport, Conn.

Speed Control

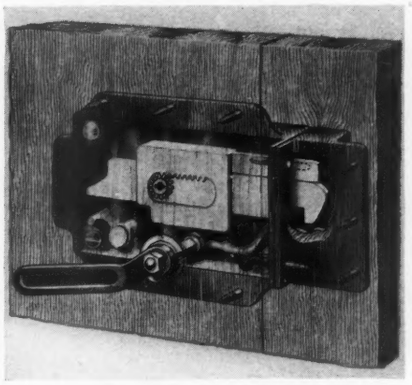
Automatic, for use with variable speed transmission. Input shaft of transmission drives gear reducer through roller chain. Output shaft of reducer connected by adjustable arm to ratchet which is mounted on extension of speed-changing screw of transmission. Adjustable arm permits increase or decrease in timing of control. When limit and end of run are reached, transmission is shifted by hand back to starting-speed position, and ratchet is reset by hand lever. Reeves Pulley Co., Columbus, Ind.

Truck

For handling coiled stock. Non-tilting, high-lift model with hydraulic lift and overload protection. Equipped with ram carrying 4,500 lb. load. Extra large battery compartment. Double-reduction bevel- and spur-gear drive axle, semi-elliptic spring suspension, safety brakes, ball bearings, magnetic contactor control. Heavy steel-plate guard around operator's platform. Vertical-wheel steering. Mercury Mfg. Co., 4100 S. Halsted St., Chicago.

Couplers

For airline equipment. Operated by plug-in motion. Tripping deflator and fine rubber washer, replaceable when worn. No. 8052 has swivel construction, No. 8050 is stationary. A. Schrader's Son, 470 Vanderbilt Ave., Brooklyn, N. Y.



Door Lock

For sliding doors of any thickness. Latches automatically; unlatches by downward movement of handle. Keys are used only to lock or unlock door. When key is turned, latch is held horizontal by bar moved into place by pinion gear. Second means of locking provided by trigger which when raised prevents latch from being disengaged from strike. Called "AM Springless Sliding Door Lock." 20th Century Lock Co., 3154 E. 133d St., Chicago.

Stoker

Applicable to all types and sizes of boilers up to 400 hp. Made in center- and side-retort arrangements and employs combination of screw and reciprocating feed for coal. Alternate fixed and moving grate bars have ports through which air is admitted. Constant-speed motor, and variable-speed transmission providing 16 rates of coal feed. Called "C-E Stoker Unit." Combustion Engineering Co., Inc., 200 Madison Ave., New York.

Drills

Two small and three heavy duty models. Small models are $\frac{5}{16}$- and $\frac{1}{4}$-in. drills available in speeds of 2,000, 2,500, 3,000, and 3,700 r.p.m. Length, $7\frac{1}{2}$ in.; diameter, $3\frac{5}{16}$ in. Die-cast aluminum alloy body. Handle centered below body of tool. Two-pole switch. Heavy duty models come in $\frac{3}{8}$-, $\frac{1}{2}$-, and $\frac{3}{4}$-in. sizes. Built for tough drilling jobs. Helical gears. Die-cast aluminum alloy housing. Three-jaw geared chuck used in $\frac{3}{8}$- and $\frac{1}{2}$-in. models, taper socket on $\frac{3}{4}$-in. model. Skilsaw, Inc., 3345 Elston Ave., Chicago.

Pumps

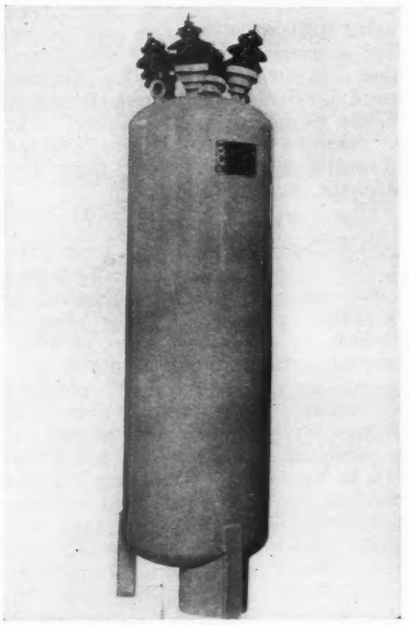
Heavy duty rotary for all kinds of clean liquids, including those that are viscous, corrosive, or solidifying. For pressures up to 300 lb. per sq.in., temperatures up to 650 deg. F, with capacities of 10-2,500 gal. per min. For viscous and solidifying liquids, pumps are steam-jacketed. For high temperatures, stuffing boxes are water-jacketed. Internal sleeve and internal roller bearings are used for noncorrosive liquids; external ball bearings for corrosive liquids. No valves and no gaskets. Will handle considerable vapor, air, or gas suspended in liquid. Known as "Double Helical Rotary Pumps." Types GS, GR, and GE. Worthington Pump and Machinery Corp., Harrison, N. J.

Protective Coating

Called "Triple Life." Applied by spray gun, soft cloth, or lamb's wool applicator over paint, varnish, polished surfaces, and metal to preserve finish. Leaves thin protective coating. Quick drying. Franklin Research Co., Philadelphia.

Capacitor

Called "Permittor." Gas-filled. Sizes 30-150 kva.; for voltages over 600. Manufacturer claims that it is fire- and



explosion-proof. Gas pressure gage mounted at bottom with strong guard to protect against damage. For pole or wall mounting. Products Protection Corp., 230 Park Ave., New York.

Polishing Wheel

Made of strong vegetable fiber and a bonding agent. Metal hub. Any diameter from 6-24 in. and any width from $\frac{1}{2}$-4 in. Three different densities. Not harmed by water. Called "Columbian Polishing Wheel." Divine Brothers Co., Inc., Utica, N. Y.

Sheave

Called "Vari-Pitch Texrope." Pitch diameter may be changed to give 15-25 per cent speed variations per sheave. Two multi-groove types: stationary- and motion-controlled. Stationary-

controlled for applications requiring occasional changes of speed; motion-controlled for frequent quick changes while drive is in operation. Allis-Chalmers Mfg. Co., Milwaukee.

Hoist

Spur-gear, twin-power, gravity-lowering, chain hoist. Twin levers, with rope pull, operate on face of disk wheels by friction grip. Pull on release rope allows load to be lowered by gravity, governor controlling speed of descent. Four capacities; ¼, ½, 1, and 2 tons. Two small sizes operate on direct drive; two large sizes are built with planetary gears. Coffing Hoist Co., Danville, Ill.

Power Unit

Constant-speed motor and variable speed transmission in fully inclosed unit. Manufacturer claims positive drive under all conditions. Speed ration 6:1; speed may be selected before starting or changed while running. Automatically shifts to low-speed position when stopped. Direct or remote fingertip control of speed. May be mounted in any position. Called "Transitorq." The New Departure Mfg. Co., Bristol, Conn.

Cycle Recorder

For use in calibrating, adjusting, or recording resistance welder timers. Records on paper the cycles of duration of current flow. Contains frequency-responsive element, marking mechanism, paper-tape supply and drive. Frequency-responsive element is polarized reed driven by coil which can be tapped at 1 or 5 amp. Stylus carried by vibrating reed presses lightly on moving strip of very thin paper under which rotates graphite roll. Small a.c. motor drives both graphite roll and recording tape. Dimensions, 5½x7½x7½ in. General Electric Co., Schenectady, N. Y.

TRADE LITERATURE

ABRASIVES—Booklet, on Titan Steelbacs, abrasive disks. — Charles H. Besly & Co., 118-124 N. Clinton St., Chicago.

ACCUMULATORS — Bulletin RA-35-5, on Ruths Accumulators for steam storage.—Foster Wheeler Corp., 165 Broadway, New York.

AIRBRUSH — Bulletin H6-35, describing High Production Airbrush. — Paasche Airbrush Co., 1909-27 Diversey Parkway, Chicago.

ARC WELDING—Booklet, title "Simplified Arc Welding." — Hobart Brothers Co., Troy, Ohio.

BEARING BRONZE — Folder, listing cored and solid bars of bearing bronze. —Magnolia Metal Co., 120 Bayway, Elizabeth, N. J.

BEARING METAL — Leaflet, announcing anti-friction metal, babbitt, and bearing bronze bar stock.—Magnolia Metal Co., Elizabeth, N. J.

BELTING — Booklet, on continuous vulcanization process for transmission belting.—Boston Woven Hose & Rubber Co., Cambridge, Mass.

BELTING — Booklet, on leather belt manufacture.—Chas. A. Schieren Co., Bristol, Tenn.

BELTING — Folder, on Tannate leather belting and packings.—J. E. Rhoads and Sons, 35 N. Sixth St., Philadelphia.

BLAST CLEANING—Folder, showing machine for airless blast cleaning.—Pangborn Corp., Hagerstown, Md.

BRUSHES—Catalog, showing line of paint and miscellaneous brushes. — David Linzer & Sons, Inc., 10-20 Astor Pl., New York.

CABINETS—Folder, No. 50, on sectional cabinets for small parts and supplies.—J. D. Warren Mfg. Co., 1471 Merchandise Mart, Montpelier, Ohio.

CAPACITORS — Folder, title "Stop Power Factor Wastes with Permittors." — Products Protection Corp., New Haven, Conn.

CASTER—Leaflet, announcing Forge-Weld Truck caster.—The Service Caster & Truck Co., Albion, Mich.

COMBUSTION CONTROL — Bulletin No. 102, on air-operated combustion control. — Bailey Meter Co., Cleveland, Ohio.

COMPRESSORS—Bulletin 759, on two-stage, air-cooled compressors.—Chicago Pneumatic Tool Co., 6 E. 44th St., New York.

CONTROL—Folder, on hydraulic automatic control for variable speed transmissions.—Reeves Pulley Co., Columbus, Ind.

CONVEYORS — Catalog, on conveyors for foundries, with many illustrations. — Mathews Conveyer Co., Ellwood City, Pa.

CONVEYORS — Two catalogs, one on gravity roller conveyors and one on design of conveyors and solving of handling problems. — Standard Conveyor Co., North St. Paul, Minn.

COUPLINGS—Folder, on pipe line couplings.—S. R. Dresser Mfg. Co., Bradford, Pa.

DRAWN STEEL—Folder, emphasizing machinability of drawn steels.—Union Drawn Steel Co., Massillon, Ohio.

ELECTRIC HAMMER—Folder, showing combination electric hammer and drill. —Wodack Electric Tool Corp., 4627 W. Huron St., Chicago.

ELECTRIC TOOLS—Catalog No. 4, on electric Tools. — Millers Falls Co., Greenfield, Mass.

ELECTROPLATING—Folder, describing

(Continued on advertising page 86)

Books

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LABOR IN COLONIAL NEW YORK, 1664-1776

Samuel McKee, Jr., Ph.D. Columbia University Press, N. Y. 193 pages, bibliography. $3.

A monograph on the kinds and conditions of labor in colonial New York before the Revolution. Covers free labor, apprenticeship, indentured servitude, and slave labor.

•

FINISHING METAL PRODUCTS

Herbert R. Simonds, Product Engineer, General Manager, Metal Products Exhibits, Inc. McGraw-Hill Book Co., Inc., 330 W. 42d St., New York. 337 pages, index. $3.50.

Detailed working information about various types of finishes applied to metal including preparation for finishing, polishing and buffing, plating and spray coating, painting, and special finishes. Also a chapter on selection of finish for sales or other purposes.

•

KEYSTONE COAL BUYERS MANUAL

Edited by Sydney A. Hale, editor, *Coal Age*. McGraw-Hill Publishing Co., Inc., Catalog & Directory Division, 330 W. 42d St., New York. 458 pages, maps, tables, illustrations. $10.

New edition, revised, expanded. Indexes mines, companies, sales agents. Covers coal fields of United States; classification of coals by ranks, by use (including industrial coals, size of stoker equipment, powdered coal), and by physical structure; composition of coal; bituminous coal preparation; coal selection in eastern states; geographical differences in coal selection; steam plant characteristics and their influence on coal selection; and other phases of coal buying.

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On the Calendar

OCTOBER

——November 11.—California Pacific International Exposition, San Diego. Headquarters, Administration Bldg., Balboa Park, San Diego.

14-18, Annual Safety Congress and Exposition, Louisville

21-25, Industrial Materials Exhibit, Hotel Astor, New York.

NOVEMBER

12-15, International Acetylene Association, 36th annual convention, Cleveland. H. F. Reinhard, secretary, 30 E. 42d St., New York.

DECEMBER

2-7, 15th Exposition of Chemical Industries, New York. Headquarters, Grand Central Palace, New York.

MORSE MAGIC SELECTOR

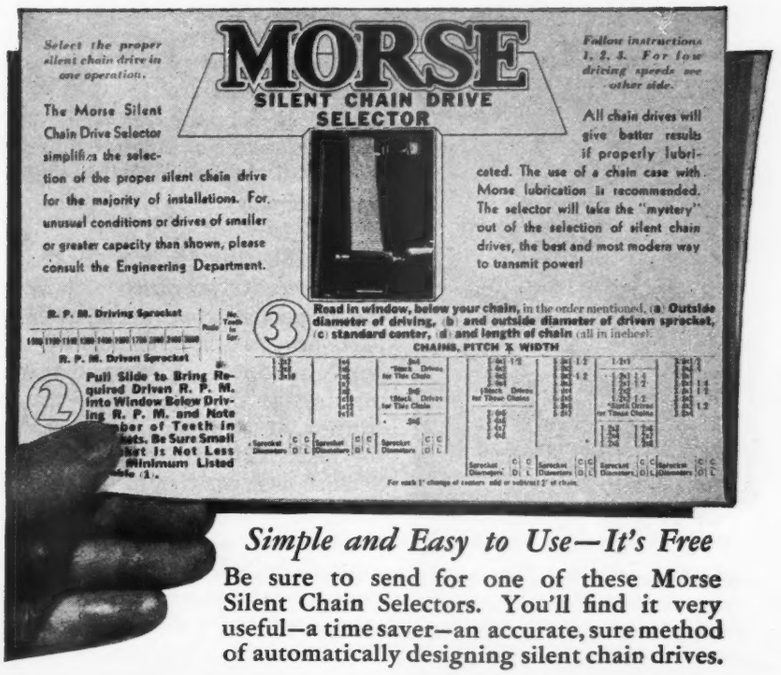
TAKES "MYSTERY" OUT OF SILENT CHAIN DESIGNING

Automatically Designs Silent Chain Drives

As usual, Morse is ahead in serving industry. This time we have developed the Morse Silent Chain Selector—a perfected device that takes all the mystery out of selecting the correct silent chain for any drive from ½ H.P. to 150 H.P., covering practically all possible chain drive installations . . . proper chain length, pitch, minimum number of teeth, power requirements are all easily obtained.

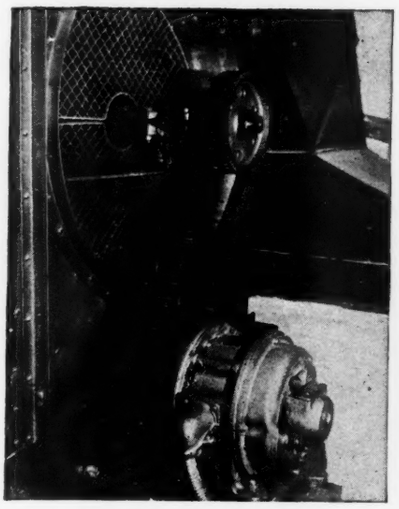
With this new selector you can design silent chain drives easily and receive the many advantages which these time-proven drives provide—flexible, positive, long-life, low first and maintenance cost, adaptable to any centers.

This new aid to industry is ready for distribution to users and designers of silent chain drives. Write Morse Chain Company, at Ithaca, New York, for the Morse Silent Chain Selector.


MORSE
SILENT CHAIN DRIVE SELECTOR
Select the proper silent chain drive in one operation.
The Morse Silent Chain Drive Selector simplifies the selection of the proper silent chain drive for the majority of installations. For unusual conditions or drives of smaller or greater capacity than shown, please consult the Engineering Department.
Follow instructions 1, 2, 3. For low driving speeds see other side.
All chain drives will give better results if properly lubricated. The use of a chain case with Morse lubrication is recommended. The selector will take the "mystery" out of the selection of silent chain drives, the best and most modern way to transmit power!
R. P. M. Driving Sprocket
R. P. M. Driven Sprocket
2 Pull Slide to Bring Required Driven R. P. M. into Window Below Driving R. P. M. and Note Number of Teeth in Sprockets. Be Sure Small Sprocket Is Not Less Than Minimum Listed Above (1).
3 Read in window, below your chain, in the order mentioned, (a) Outside diameter of driving, (b) and outside diameter of driven sprocket, (c) standard center, (d) and length of chain (all in inches).
CHAINS, PITCH X WIDTH

Simple and Easy to Use—It's Free

Be sure to send for one of these Morse Silent Chain Selectors. You'll find it very useful—a time saver—an accurate, sure method of automatically designing silent chain drives.

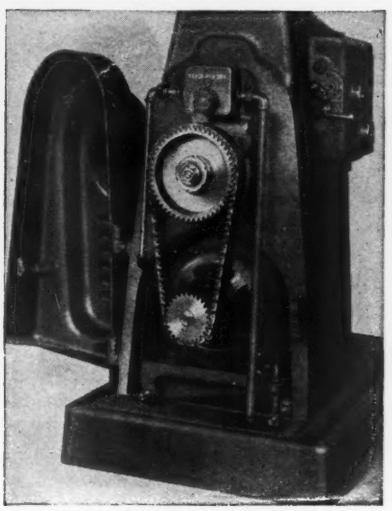


For Fan Drives

One of the eighty fan drives in Baker Laboratory at Cornell University—Morse Silent Chains have been successfully used as drives on this equipment over a period of years.

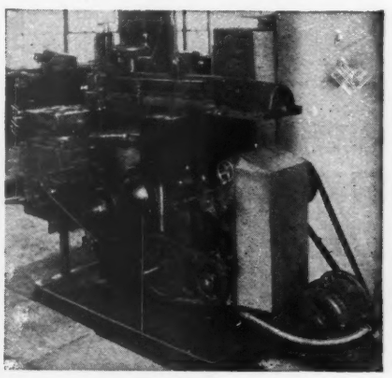
20 Years of Service

By the time any piece of equipment has rendered 20 years of service in any one plant, it may be regarded as an old friend. A prominent knitting mill in Rockford, Ill. (name on request), has 40 such friends in the shape of 40 Morse Silent Chain Drives that have been running for a generation. These are 2½" units, transmitting 13 H.P. between 17 and 49 tooth sprockets.



On Milling Machine

Machine Tool manufacturers are large users of Morse Silent Chains. No other form of drive is as reliable, positive, efficient and economical, and simple and easy to install.



Box Making Machine Installation

An installation of Morse Silent Chains on a box making machine. Note motor drive to variable speed transmission and drive from transmission to machine—a typical and satisfactory installation.

Did you attend the Machine Tool Show? Everybody there came away with an appreciation of many advances made in machine tool design and manufacture. Probably no show in years has been better attended . . . a definite indication of the upward business trends in industry.

MORSE CHAIN COMPANY, ITHACA, N. Y.

DIVISION OF BORG-WARNER CORPORATION

DOING THINGS TO PLANT MAINTENANCE COSTS

WITH THE SIMPLIFIED P & H-HANSEN ARC WELDER

Whether it's repair work or occasional production jobs around the shop, it's a matter of sound economy to own a P&H-Hansen Arc Welder. . . . Here's a welder that's built for years of tough service. The stable arc is "built in" . . . inherent . . . not obtained with external attachments. It's easier to operate, too, with simple current control over the entire welding range. Offered in all capacities from 50 to 800 Amps., portable, stationary or vertical models. Ask for Bulletin HW-3.

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

P&H HANSEN ARC WELDERS

They Don't Chance Quality

(Continued from editorial page 417)

working. Foremen are held responsible for control of process. The president of the company spends part of his time in the shop, and (a somewhat unusual arrangement) the salesmen also often visit the shop, suggest designs for the factory to develop as samples, and keep an eye on work requiring special finish or unusual construction. The organization employs about 100 men.

IV

Electrical Apparatus. Many of the inspection operations, made on parts produced in large quantity, are purely routine, such as go-no-go gaging, testing the intensity of magnetization of steel magnet cores, and the like. This type of inspection is handled as a position in the progressive process or assembly line. Other work, such as circuit checking on switchboards, is non-routine, the operator requiring special training and experience, and working from circuit diagrams. Specifications for inspection methods and tools, including specifications of percentage to be inspected, are developed by a division of the engineering organization.

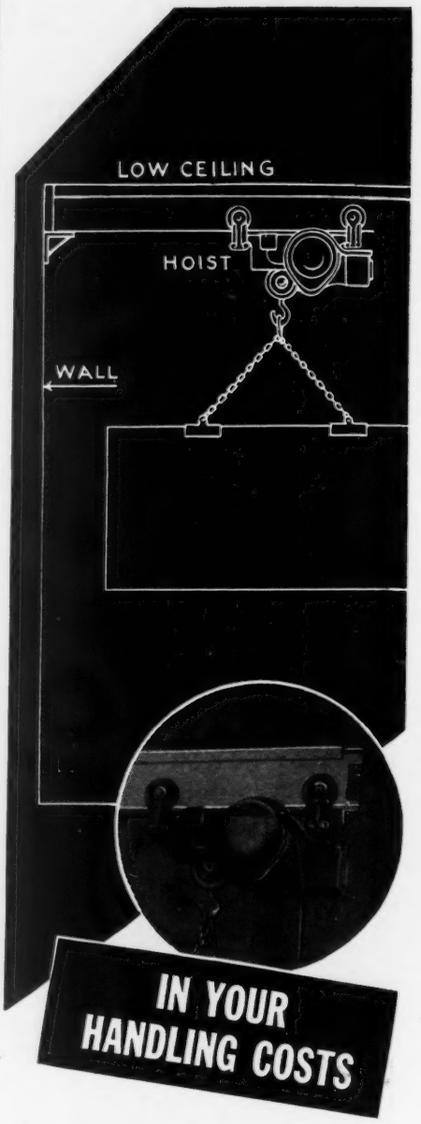
V

Heavy Machinery. Foundry work is cleaned and inspected by a gang working under a foreman who reports to the foundry superintendent. The pay of molders is based on the number of good castings, so that the cleaning gang has a responsibility for careful inspection.

Finish and accuracy of the machine-shop operations is passed on by the various foremen concerned. Assembly provides a check on the foreman's thoroughness. Practically every job, except smaller repair and replacement orders, is assembled and given a running test before it leaves the factory, under the supervision of an inspector who reports to the engineering department. It is then disassembled and shipped for field erection, which provides an additional check on errors or defects.

▼ ▼ ▼

DESIGNED TO SAVE YOUR DOLLARS



IN YOUR HANDLING COSTS

P&H hoist engineers can help you store your raw materials, and also speed up loading.

Note, for example, the manner in which they licked one storage problem where a manufacturer required low head room with a lift to within a few inches of the ceiling.

P&H engineers will carefully study your specific requirements before they recommend equipment. If they can't save you money, they'll frankly tell you so. Ask for catalog RH-2.

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

P&H MILWAUKEE ELECTRIC HOISTS

CHECK THESE 5 ADVANTAGES OFFERED BY DAYTON COG-BELT DRIVES

Today, you'll find Dayton Cog-Belt Drives in every industry. And among the hundreds of thousands of these drives in daily operation a very large number are being used on compressors of all sizes and types. Manufacturers and users of compressors have selected Dayton Cog-Belt Drives because of these outstanding advantages:

1. *Minimum Space Required* without the use of idlers or other tension devices.

2. *Ruggedness* and the ability to withstand severe starting and operating conditions.

3. *Positive Speed,* resulting in maximum capacity even under pulsating loads.

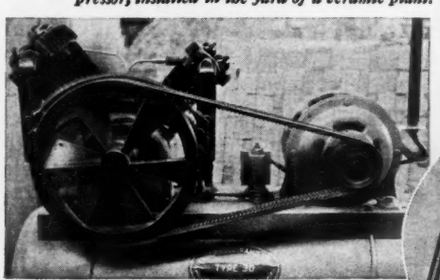
4. *Low Maintenance Cost*—fewer belts required. No lubrication or dressing necessary. Longer life.

5. *Impervious to dirt,* dust and moisture.

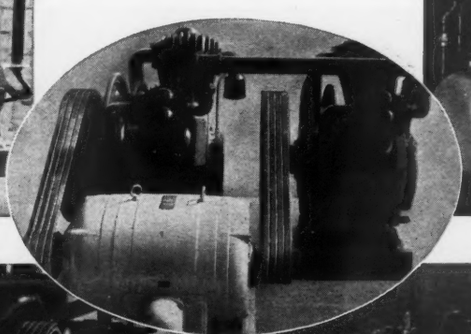
These important characteristics make Dayton Cog-Belt Drives the most economical and efficient drives for all types of machinery and appliances—or wherever power transmission is involved.

Dayton Cog-Belt Drives on your machinery will quickly demonstrate *all* of these advantages. Let us send you complete information.

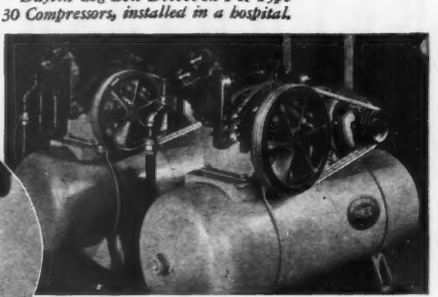
• *Dayton Cog-Belt Drive on I-R Type 30 Compressor, installed in the yard of a ceramic plant.*



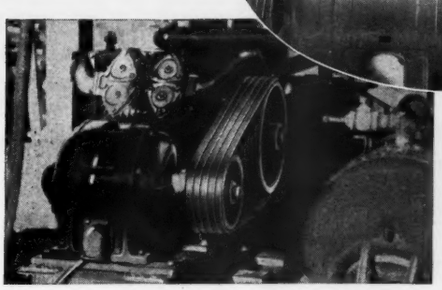
• *Dayton Cog-Belt Drives on two I-R Type 30 Compressors, mounted on a common sub-base.*



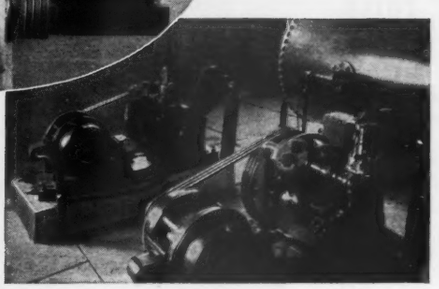
• *Dayton Cog-Belt Drives on I-R Type 30 Compressors, installed in a hospital.*



• *Dayton Cog-Belt Drive on I-R Type 40 Compressor used to supply air to operate concrete vibrators, air driven sump pumps, etc., in one of the Caissons, San Francisco—Oakland Bridge.*



• *Dayton Cog-Belt Drives on two 5 H.P. channel mounted I-R Type 30 units in a steel mill.*

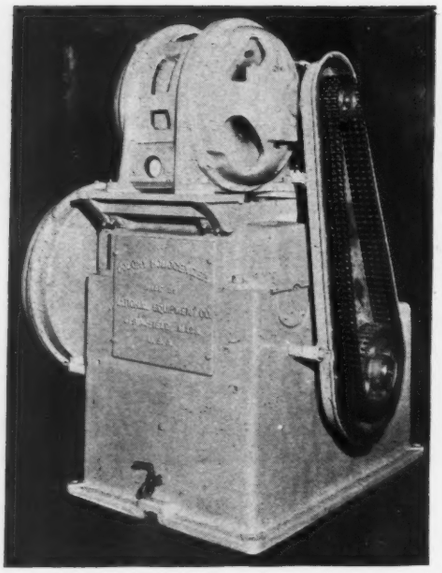


THE DAYTON RUBBER MANUFACTURING COMPANY, DAYTON, OHIO

The World's Largest Manufacturers of V-Belts. Manufacturers also of Dayton Fan Belts, Dayton Red Tube Radiator Hose and the famous Dayton Thorobred Tires and Tubes.

Dayton
COG-BELT DRIVES

Cog-Belt Drives—F.H.P. V-Belt Drives—V-Flat Drives—Complete Drives, Pulleys and Belts in Stock. Fractional to 100 H.P.



A SUGGESTION for Positive Machine Drive

A quadruple-width Baldwin-Duckworth roller chain gives positive drive to this homogenizer from the 20 hp. motor located above it. There is no power loss, no slippage. The drive is positive, dependable, long lived and low in first cost.

Wherever power must be transmitted from one shaft to another without slippage or appreciable power waste, consider Baldwin-Duckworth Machine-Finished Chains.

Send for the Baldwin-Duckworth Chain Book. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

BALDWIN-DUCKWORTH

NEW TYPE

SLINGS

LESS THAN 2" THICK

AD NO. 176

They had to be flat—to meet a clearance of only 2¼ inches.

They had to be flexible, easy to handle—yet capable of lifting 50-ton loads!

To meet these rigid specifications, Macwhyte designed and built these 6-part DREW Slings of Monarch Whyte Strand Wire Rope—made endless and then braided flat to give a *flexible non-kinking, non-spinning* body. This patented construction speeds up loading and gives an unusually high safety factor.

Drew Slings are custom-built for all kinds of lifting jobs, especially for those having small clearance requirements. Write for catalog.

At the 24th Annual Safety Congress, Louisville, visit Booth 35 and see the Macwhyte Sling Exhibit.

MACWHYTE

WIRE ROPE *Slings*

ATLAS • DREW • MONARCH

MACWHYTE COMPANY, Kenosha, Wisconsin

Government, Employers, Employees

(Continued from editorial page 424)

•

up a Commission with power to issue licenses to firms manufacturing textile products. It would limit man-hours and work-load and would establish minimum pay and a dismissal wage.

One of the features of this bill is that use of the mails for the shipment of or correspondence concerning textile products, transmission of money or any other material or information in connection with textile products would be denied unlicensed manufacturers.

Teeth would be contained in the provision that there could be no government money for non-licensed mills, no dealings by such mills with banks that borrow or have borrowed Federal money; and no Federal money could be loaned to states, or other political subdivisions, or carriers, or finance institutions dealing with unlicensed mills.

This proposed provision of the Textile Bill conceivably would be extended to enable the Federal Government to refuse postal service to employers engaged in congressionally defined unfair labor practices.

The Textile Control Bill has been introduced and referred to the House Labor Committee.

Licensing Bill

The Federal Licensing Bill is backed by the American Federation of Labor. It has been introduced and referred to the House Interstate Commerce Committee.

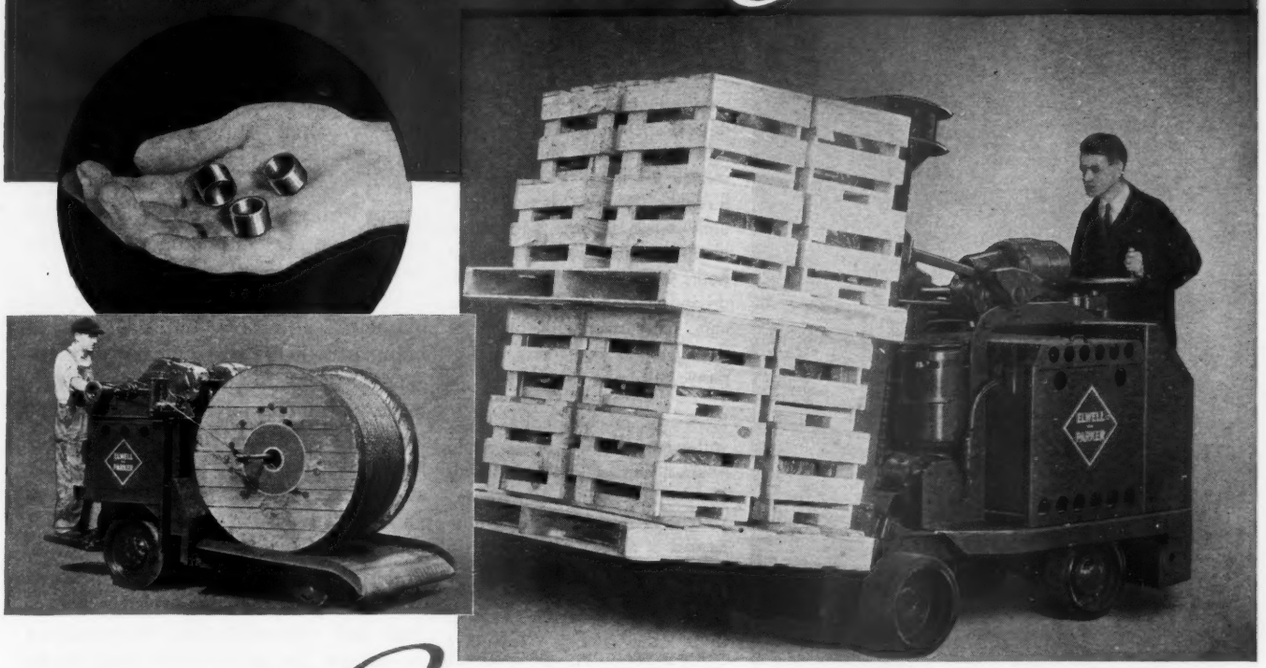
This bill would provide for licensing by the Federal Government of all corporations engaged in interstate commerce. But, whenever it was shown that output of an unlicensed (intrastate) producer interfered with "effective handling" of the output of a licensed producer, the unlicensed output would be brought under license after hearing.

A limit on corporation surpluses would be set. Surplus in excess would be distributed to stockholders. But if dividends the year before had been as much as 10 per cent, the excess surplus would be divided among employees.

There is another provision—most interesting of all at the moment. It

(Continued on page 66)

ELWELL-PARKER *Customers:*



NOT THE *Size* OF YOUR FINISHED UNITS...BUT THE WAY YOU HANDLE THEM

OUNCES or tons? It made little difference how much the units of your finished product weighed when you bought your first Elwell-Parkers; and it makes no more difference now. But *these* factors *do* count:

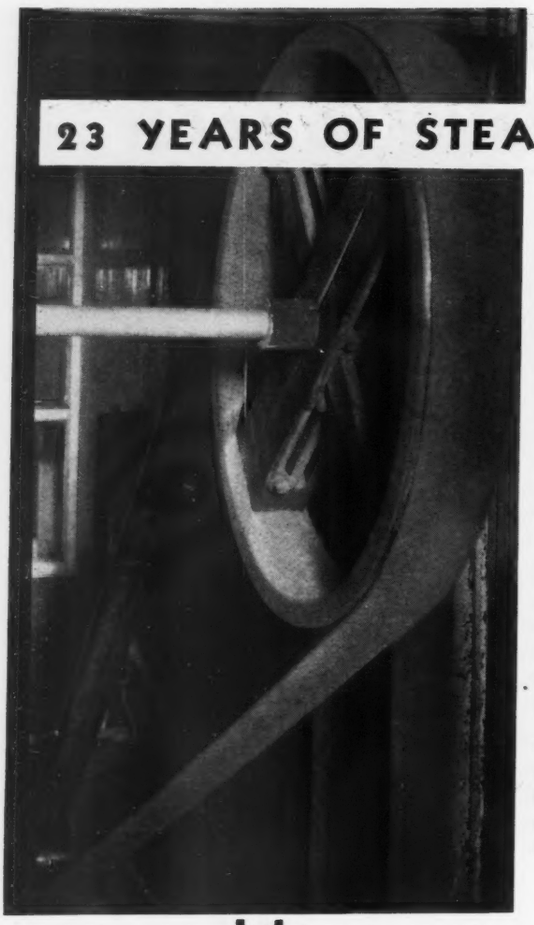
How are you transporting between departments? How high do you tier in storage? How speedily can you deliver from warehouse to shipping dock? Even though your handling methods have been efficient, are you satisfied they are earning their share of plant economies *today?* And *have* you that comfortable feeling that they will meet trends *already* evident?

If you can't answer "yes," then it's time for you to modernize your transportation methods again. Elwell-Parker is ready with Trucks, Tractors and Cranes for handling every kind of product during manufacture and transportation. Your choice of power—electric, gas, gas-electric—newly redesigned, modern to the minute.

To make *sure* your handling costs are at bedrock, send for trained Elwell-Parker Engineers to study and analyze your plant conditions. Better write or wire today. The Elwell-Parker Electric Co., 4323 St. Clair Ave., Cleveland, O.

New ELWELL·PARKER *Fork trucks*

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906



23 YEARS OF STEADY SERVICE

Installed in 1912, this 6" double Schieren Leather Belt has given steady, uninterrupted service 24 hours a day—never less than 9, seven days a week until three months ago when running time was cut to 9 hours a day, six days a week driving main shaft to churns and pasteurizers in plant of the Mutual Creamery Company, Salt Lake City, Utah.

From its present appearance, writes Mr. Walter Levack of the Mutual Company, this belt will no doubt continue to give excellent service for quite a long period of time.

The service this belt has given shows that Schieren Leather Belts "can take it" and give many profitable years of service to the user.

●

We have issued an interesting booklet, called "Schieren-izing" that shows you Why Schieren Leather Belts are your Best Investment for power transmission as they have proven in this particular case. Write for a copy.

SCHIEREN BELTING *and Specialties*

DUXBAK BELTING TRADE MARK

Chas. A. Schieren Company

ESTABLISHED 1848

Tanners and Manufacturers of LEATHER BELTING, PACKINGS and SPECIALTIES

Main Office and Factory:

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Branches and Distributors in All Principal Cities

DUXBAK WATERPROOF BELTING • DUXBAK ROUND BELTING • SCHIEREN BELT CEMENT AND BELT LACING • FLYFOOT BELT DRESSING • NATURAL GRIP BELT DRESSING AND PRESERVATIVE • BELT HOOKS • BELT COUPLINGS • LEATHER TEXTILE SPECIALTIES • LEATHER PACKINGS

(Continued from page 62)

is that rates of pay of employees would be increased and hours of work decreased in accordance with gains in the productive efficiency of industry arising from increased mechanization and improvements in technological methods.

The objective of the provision just referred to is "to the end that employees shall have an equitable participation in the output of industry, and that mass purchasing power may keep pace with the productive accomplishment of industry."

Which, of course, is a laudable and blameless objective, but one that is being attained right along. Any increase in standard of living is a measure of the advance toward that objective. Such advances come about by evolution, not legislation. The slight increments, that make a fine showing in the aggregate, are not definitely measurable by individual machine, department, or plant. Even if they were, the measuring, recording, and rate-adjusting bureaucracy necessary to meet conditions would be unsupportable. The difficulties in employer-employee relations that would ensue are too complicated to contemplate.

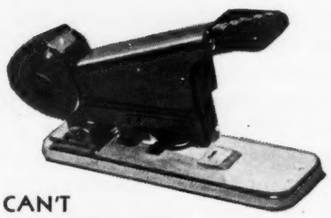
These legislative actions and proposals to which I have referred have had or can have direct effect upon employee - employer relations. The laws themselves, the discussion that has accompanied their consideration, the renewed activities of organized labor leaders have brought about changed attitudes on the part of workers.

Where the Trend Leads

Speaking broadly, the trend of Government influence is forcing an educational program upon employer, employee, and Government itself. It is disclosing the need for the employee to know the truth about the business affairs of his company, the need for the employer to know why employees feel and act as they do, and the need for the Government to know more of the true economics of industry.

This situation puts a triple burden upon the employer, the burden of educating himself, of educating his employee, and of doing his fair share in placing practical economic facts and industry statistics before the Government. *(Continued on page 69)*

FREE 10 DAY TRIAL



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JAM OR CLOG

BATES STAPLER

Makes its own staples.
5000 in one loading.

For free trial, without obligation or expense, simply return this advertisement attached to your business letterhead.

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The BATES MFG. CO. 30 Vesey St., New York
MAKERS OF BATES NUMBERING MACHINES

Amazing New Tool Saves Time, Money, Trouble

● POWER-TWIST Waste Line Cleaner clears bad stoppages up to 50 feet from opening. Operation simple, quick, clean. No loose, greasy rod to struggle with and dirty up everything.

POWER-TWIST feeds in rod with pumping motion, reels out rod when done. Easily clears all elbows and fittings. Delivers continuous boring action with powerful thrust on stoppage.

POWER-TWIST is light, handy. Made of aluminum alloy, with special 3/8" music steel spring rod. Used in hundreds of nationally known institutions.

End your stoppage problems *today*. Write

THE STANDARD APPLIANCE CORP.
200 Hickory Street Dayton, Ohio

(Continued from page 66)

I do not see anything fundamentally unsound in the theory that workers, if they wish to do so, should select a few from their number to negotiate with their employers concerning the conditions under which they are to work, the hours they are to work, and the pay they are to receive. But I do think that, no matter how honest the representatives selected, they cannot be trusted to exercise their authority, except under definite restrictions, especially so long as they have at their disposal a weapon so potent as the strike. Up to date these restrictions have not been provided in our legislation.

Nor do I believe that such representatives are likely to be as considerate of the national welfare (which, in the long run, means the welfare of those they represent) as they would be if they had a proper understanding of our industrial economy.

The Duty of Employers

In this situation I perceive it to be the duty of employers (i.e., management) to engage unsparingly in the effort to show the nation's workers:

That their ability to have depends entirely upon how much they produce.

That wealth is *not* measured in the hourly wage rate that a given group can establish for itself.

That it *is* measured in the number and kind of houses in which people live, the number of automobiles at their disposal, the rugs on their floors, the radios, telephones, electric lights, and washing machines in their houses.

That all these things cannot be distributed until they are made, and that they cannot be made until the cost of their production becomes so low that their selling prices will induce that distribution.

One way for the individual employer to do a part of the educational job is by rendering to the worker a financial and operating statement, just as he does to his stockholders. It is not enough to pass out generalities showing, for example, that in our most prosperous years the average earning in all manufacturing plants was 6.6 per cent of the income from the sale of goods. What the worker wants to know is the situation within *his* company and whether or not it is true that *his*

WORTHINGTON DEAERATING FEEDWATER HEATERS

SAVE FUEL

BY INCREASING BOILER FEEDWATER TEMPERATURE

Also...by removing free oxygen from the feedwater...*they*

- *INCREASE BOILER EFFICIENCY*
- *REDUCE BOILER REPAIRS*
- *REDUCE BOILER CLEANING*
- *PROLONG LIFE OF BOTH BOILER AND PIPING*

WORTHINGTON Feedwater Heaters are built to meet individual plant requirements. There is a type and size for *your* plant . . . and the services of experienced Worthington engineers are available to assist you with your feedwater problems.

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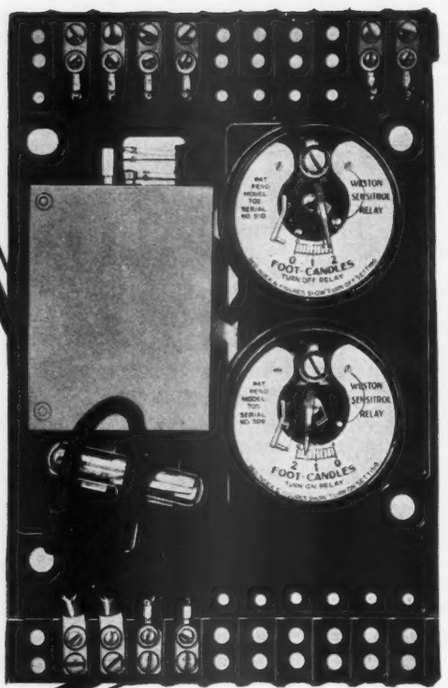
DON'T LEAVE THE *Control* OF PLANT LIGHTING TO GUESS-WORK OR CHANCE



obtain *full* efficiency
WITH THE
WESTON
AUTOMATIC ILLUMINATION CONTROL

MODEL 709
Weston Illumination Control Relay
Furnished in attractive case for wall mounting. Adjustments of both the "turn-on" and "turn-off" values can be made without removing cover. Light target can be mounted wherever needed; far removed from the control box if necessary.

You have carefully planned your plant lighting with greater efficiency in mind. *Don't*, then, leave the control of this lighting to guess-work or chance. Be *sure* lights are on when daylight falls below the light level essential for efficient work. Be sure they are never left burning needlessly. An automatic and inexpensive WESTON *Photronic Illumination Control will completely solve this problem. It will turn on the lights when needed, and turn them off when not needed . . . and it costs practically nothing to operate. Let us send you full data on this simple, proved device. Return the coupon today . . . Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark, New Jersey.

*PHOTRONIC—a registered trade-mark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corp.

WESTON *Instruments*

WESTON ELECTRICAL INSTRUMENT CORP.
628 Frelinghuysen Ave., Newark, N. J.
Send us full information on Weston Automatic Illumination Control.

Name.....
Company.....
Address.....

company is not justified in giving him more wages than he is getting.

This kind of educational work was going on under the guidance of our best employee-representation plans until all such plans were given a black eye. Possibly it can continue in plants where representation plans were in effect before the National Labor Relations Act became a law. If it is found that the new law cannot be applied to manufacturing (a question about which there is much difference of opinion) there will be a fine opportunity for the representation plans to be increased and the educational work to be enlarged.

If it turns out that the law is universally applicable, I do not see much hope for the future of employee-representation plans. It is too much to expect in the average plant, among the workers below foreman, the type of leadership necessary for the initiation, formation, and promotion of a plan. Judgment based on precedent indicates that the Labor Board probably will rule that management must not propose the plan or formulate it. I cannot hold with such a ruling. The objective in labor relations should be to achieve a just and fair relationship. This can be done by means of employee representation. What matters it who conceives the idea, or writes the constitution?

The nub of all labor relations is wages. Too often both employee and employer have in mind wage *rates* instead of total wages. Workers in the construction industries, for example, have fought for and secured high wage rates. As is now being proved, they are of no advantage to the individual worker, because they are so high as to stop construction.

It was the annual wage that was the avowed goal of the high rate demanded by construction workers. The same reasoning would now justify a lowering of that rate to induce building and increase the annual income.

Undoubtedly, present conditions are focusing attention on the annual income basis of wage payment. Employees do not live by the piece, hour, day, or week. They live by the year. Recently, several companies have arranged with their employees for employment on an annual income basis.* It is probable that the movement will grow. *(Continued on page 72)*

*See "Paid by the Year," and "A Pay Check Every Week," *Factory Management and Maintenance*, August, 1935.

MODERNIZE FOR PROFIT

Protect Present Business . . . Fire Takes Terrific Toll

What better evidence could there be than the following published facts to prove that the installation of Grinnell Automatic Sprinkler Fire Protection is not only wise modernization but low cost assurance against business suicide.

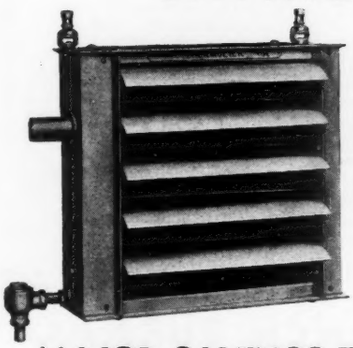
"Of all plants which are burned in the United States, 43 per cent failed to resume operations. Reductions in credit rating are suffered by 14 per cent of burned plants, 17 per cent fail to issue a financial statement, and 26 per cent lose business."

Call In The Grinnell Representative

QUARTZOID SPRINKLER

DURA SPEED
CONVECTOR TYPE SPRINKLER

SAVINGS OF 30% IN HEATING COSTS



Analysis of typical instances where antiquated heating systems were replaced with modern, efficient Thermolier installations indicates savings of 30% and over in heating costs.

In addition, plant efficiency was stepped up materially because of the uniform heat delivered by Thermoliers resulting in greater comfort to workers.

Thermolier — The Grinnell Unit Heater with 14 Points of Superiority — offers many advantages not found in the ordinary unit heater.

Call In The Grinnell Representative

MAJOR SAVINGS IN POWER EQUIPMENT

The results of a survey of 454 leading industrial plants representing approximately 15% of industry's total boiler horsepower indicate: 65% of the power equipment is over 10 years old.

50% IS OBSOLETE

Plants operating at present at less than full capacity are paying a substantial penalty for power losses because of inefficient equipment. Increased plant operation will mean increased losses.

Look to your Power Equipment for major savings through modernization.

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FHA INSURED LOANS OFFER UNUSUAL OPPORTUNITIES

The expanded Credit Plan of the Federal Housing Administration (FHA) offers a new, easy and economical means of modernizing your plant and equipment.

Money for such improvements is now available to every plant, large or small, at terms which will usually make modernization self-supporting.

The Grinnell representative will be glad to explain the details of this easy method of modernizing your plant and equipment.

Grinnell Engineered Products for profitable modernization include: Automatic Sprinkler Fire Protection; Thermolier — the Unit Heater with 14 Points of Superiority; Pipe and Prefabricated Piping; Cast Iron, Malleable Iron and Brass Fittings; Adjustable Pipe Hangers, Supports and Brackets; Welding Fittings; Traps.

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A New High Degree of Heating Efficiency and Economy

"Efficiency" and "Economy" have become more than glib selling terms—modern competitive conditions make them an absolute necessity to anyone having a building to heat.

The old methods of heating buildings are inefficient and costly. Great scientific advancements in heating large area buildings have taken place in recent years.

The newest method is "Floodlight Heating." It offers a new high degree of efficiency and economy heretofore unobtainable. It costs nothing to know the FACTS—write for them today and place the savings in bank.

L. J. Wing Mfg. Co.
162 West 14th Street,
New York, N. Y.
and everywhere

WING *Floodlight* HEATING

The idea of the annual wage basis of payment is not new. It happens that the activities of the Government during the past three years have stimulated thought about it and have made it necessary for management to check up to find out whether or not the pendulum has swung too far in the direction of piecework and other wage incentive plans without taking into consideration the worker's total living requirements.

Today the worker is on edge—is touchy. The long depression has been responsible for a part of his touchiness. Employers have been responsible for part by failing to be frank, and by chiseling. The Government has been responsible for the remainder by persistently dwelling upon the worker's right to organize to get from his employer privileges and wages said to be long overdue.

To the worker, everybody from his foreman up is his employer. The foreman is on the firing line. Next comes the personnel manager. Careful management will select to fill these important positions men who can be relied upon to know the right things to do and how to do them. The personnel duties will be accompanied by real authority and a high standing among the executives of the company.

In Conclusion

The foregoing analysis leads me to the conclusion that the trends of Government influence in employer-employee relations are:

To make industry's *employees* doubt that they are getting their just share of the country's wealth.

To make them more susceptible to the efforts of organized labor leaders.

To convince them that they have an economic right to know what is going on in the management and financial realms of the organizations of which they are a part.

To awaken *employers* to the necessity of running their businesses and their plants so that all the facts can be placed before employees.

To show them the advisability of placing these facts in the hands of their employees.

To convince them of the need for the highest type of personnel to form and carry on their labor policies—a personnel that will itself be informed and will train both second-line executives and employees in such matters as economics and management methods.

Insure AGAINST

PRODUCTION TIE-UPS..

Low cost of operation and efficient production — "Plant foremen" will tell you — frequently pivot upon the very small but very vital factor of soldering irons. Slow, cold irons that break down when most needed are the cause of many destructive production tie-ups.

Specializing, for the past eight years, in the manufacture of quality industrial soldering irons, —it is conceded that the Esico electric iron is the finest available. Your local authorized Esico distributor carries a complete line of these irons. Available from 65 to 500 watts.

Complete detailed information sent upon request.

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A TRIPLE-THREAT BENCH FURNACE!

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Heats soldering coppers, melts soft metals, and heat-treats carbon steel tools and parts. Embodies those principles of design and construction which makes the Johnson name famous. Johnson Furnaces operate efficiently and economically without forced air blast. Write for catalog giving details of the Johnson line of soldering, melting, and heat-treating furnaces.

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PATENTED
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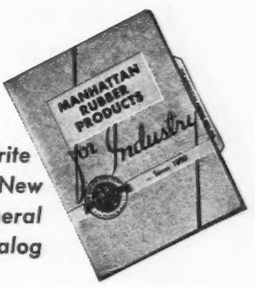
BELT FOR MAIN DRIVES

THE LOW TENSION RUBBER BELT

with equalized ply stresses

For the heavy duty of the main drive, specify Condor Compensated Belt. The 28" 9-ply Condor Compensated Belt in the illustration is one more demonstration of the safety, economy, and efficiency of this exceptional belt which, due to its scientific construction, is not overstrained by the pulley flexing.

Condor Compensated Belt is made to conform to the curvature of the pulley; each ply bearing an equal load when bent. The pulley surface has been engineered for low tension operation. Try it and be convinced.



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Condor PRODUCTS

- Transmission Belt
- V-Belt
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- Air Hose
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Let MEN do "PAY-WORK"

Take the labor off men's backs—put it on Lamson Conveyors and let men do "Pay-Work." Men want to do productive work—not needless lifting, hauling, carrying and pushing. Your Treasurer wants men more productive too. The result is obvious—greater efficiency, faster production, lower costs and more profits.

Now is the time to prepare your plant for low cost production—to effect production economies to meet growing competition. Your "conveyor dollar" goes further today. You may feel that production costs in your plant cannot be lowered. But it pays to be sure—as hundreds of your direct and indirect competitors *are* making sure. Without obligation, let us tell you more specifically what LAMSON CONVEYORS will do for you.

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FROM A 10-FOOT GRAVITY SECTION TO A COMPLETE SYSTEM

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Yes, I'm interested in finding out if you can cut our production costs. Send your Book, without obligation.

NAME .....

COMPANY .....

ADDRESS .....

Quiet on the Toledo Front

(Continued from editorial page 416)

•

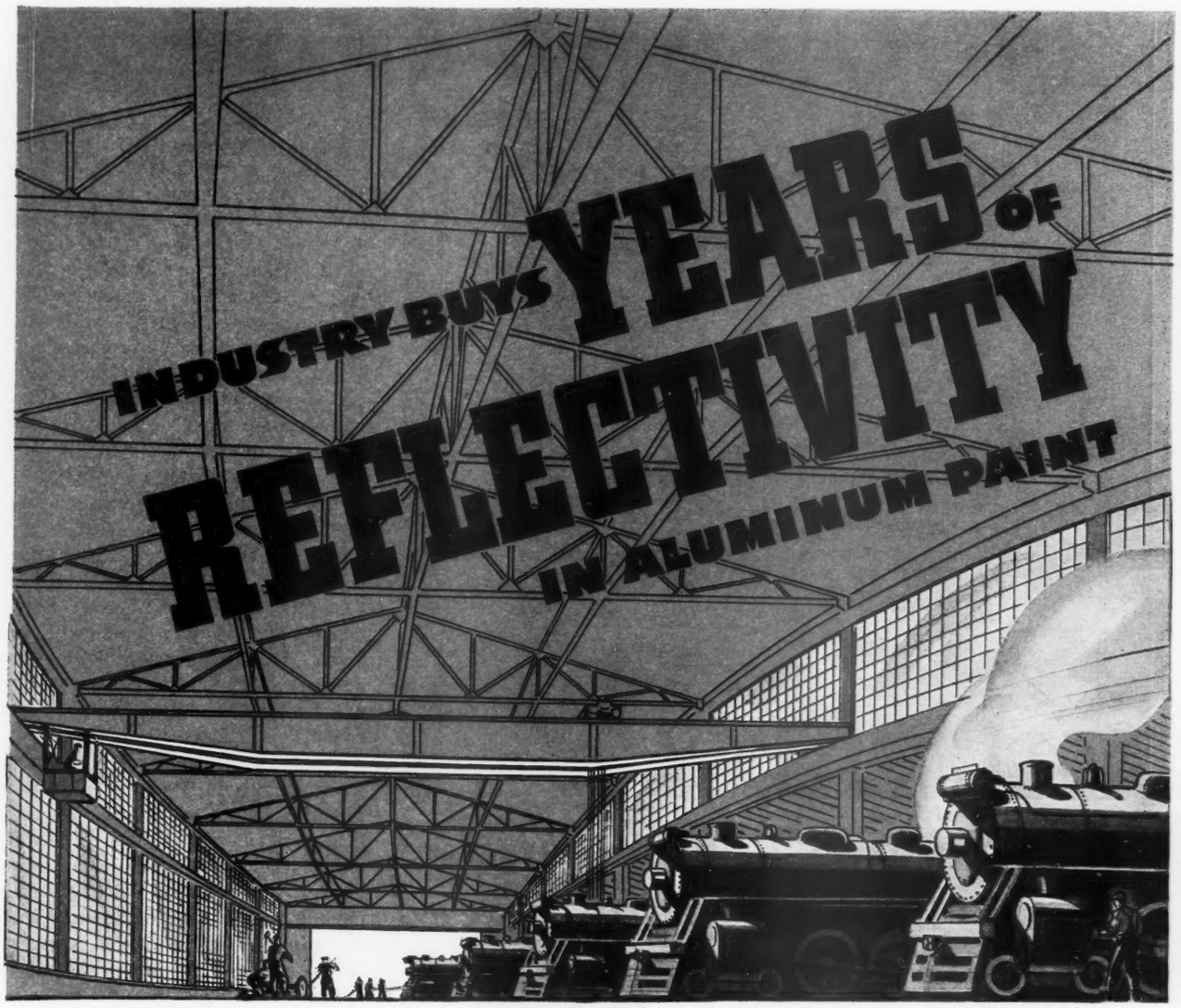
side put on a show. The company attorney made the union leader look foolish on cross-examination, and the labor attorney audited the company's books and took broad cracks at the policies and management of the holding company. To stop the show, the jury called for written briefs instead of speeches, and that is where we leave this case.

The Toledo Plan has yet to be tested with members of the panel acting as arbitrators. It is not necessary, however, for the board to sit in any case. The chairman, backed by the group, can exert a powerful influence in peaceful settlements. The board is unofficial in that its authority is only public support. It has no legal basis. Any decisions either it or its chairman makes must rest upon the consent of those who participate. Even Lind, as a government official, has no authority to enforce a decree. He must rely upon his powers of persuasion to bring both sides to mutual understanding and agreement.

Relation to LRB

One question that arises in connection with the Toledo Plan is its relationship to the new National Labor Relations Board. The former regional labor boards automatically become parts of the new set-up. This means that Lind becomes an official government mediator in his own right, with legal power to summon witnesses, take testimony, and enforce a cease-and-desist order on an employer engaged in "unfair labor practices." The National Labor Relations Act does not, however, provide machinery for mediating disputes. It merely states that an employer must bargain with a collective group of employees on wages, hours, and working conditions, and prohibits discrimination against a worker because of labor organization activities.

In effect, then, the Toledo Plan is supplementary to the National Labor Relations Board, because the Act provides no means for carrying the issue beyond the deadlock stage. In fact, it is specifically stated in Section 13 that the Act does not impede or diminish the right to strike. If



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It didn't take that long for these large buyers to discover that inferior aluminum paints could not give the desired results. Now they buy only quality vehicles made by reputable paint manufacturers and ALCOA ALBRON Paste or Powder. They make sure that the ingredients give them perfect "leafing" and a smooth, brilliant coating of metal protection. Their Aluminum Painted interiors do not readily collect dust. The reflectivity they pay for is long-lived.

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Credit is available for plant modernization. Approved banks and other institutions are prepared to lend up to $50,000, insured by the Federal Housing Administration. Information is available from your Banker.

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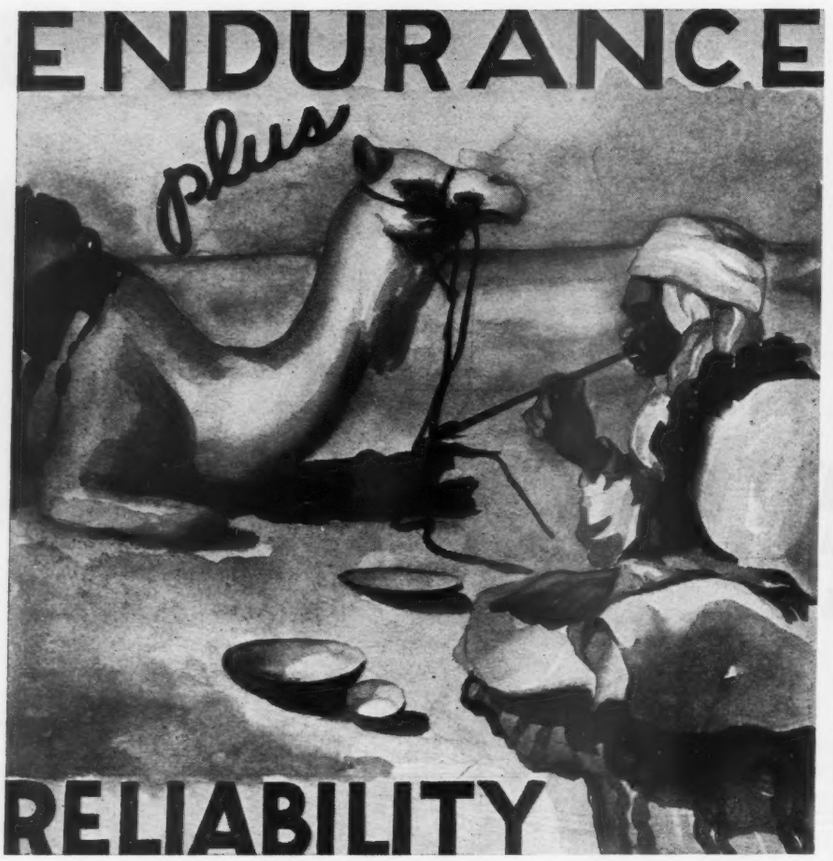

--are "inbred" characteristics of all Philadelphia Speed Reducing Products

In the final analysis, any piece of production machinery is only as good as its ability to "take it." New devices come and go throughout the years—Firms go into and go out of business, but the industrial history of America shows that a rightly designed honestly made product nearly always survives the test.

We of Philadelphia take pardonable pride in the part we have played (for nearly a half century) in helping industry solve and meet its power transmission requirements.

No doubt you have at least one drive problem which is now bothering you . . . so why not drop us a line and ask for our recommendations . . . or better still, ask one of our experienced Engineers to call.

Philadelphia Worm Gear Reducer

Horizontal MotoReduceR

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducing Units

Main Office and Works—Erie Ave. and "G" St., Philadelphia, Pa.

New York—330 W. 42nd St. Pittsburgh—Chamber of Commerce Bldg.

the Act, on the other hand, is proved unconstitutional, the Toledo Plan will be unaffected, except perhaps that its importance will be strengthened thereby.

A significant aspect of strike settlements in northern Ohio in the past year is that the majority of them involved some sort of upward wage adjustment. Labor never got all it asked for, but some concessions were made by management in every case. In their very nature, arbitration boards must effect compromises, and no clear-cut decision in favor of one side or the other is likely. What management must do, therefore, is to throw more responsibility back upon labor to see that the manufacturing enterprise is a profitable one. The settlement of the Textileather dispute is typical of what we must see more of in the future.

Members of the Peace Board themselves say the plan will not work, that it is a paper set-up that will not stand the test of a real dispute. Yet the mere fact of the board's existence has enabled its chairman to effect three settlements within a short time. An aroused public opinion and sense of civic pride will carry it through. The whip hand is held by the crusading newspapers, whose united voice is strong enough to tell labor on the one hand to "pipe down," and the manufacturers on the other not to assume an arbitrary attitude in refusing to sit at a conference table with organized labor. One manufacturing executive said his company would not submit its labor problems for arbitration before the Peace Board. Yet a moment later he followed this remark with the statement that the local press has sufficient influence on public opinion to force his company into line. That seems to be the key to the situation.

•

How We Control Maintenance

(Continued from editorial page 439)

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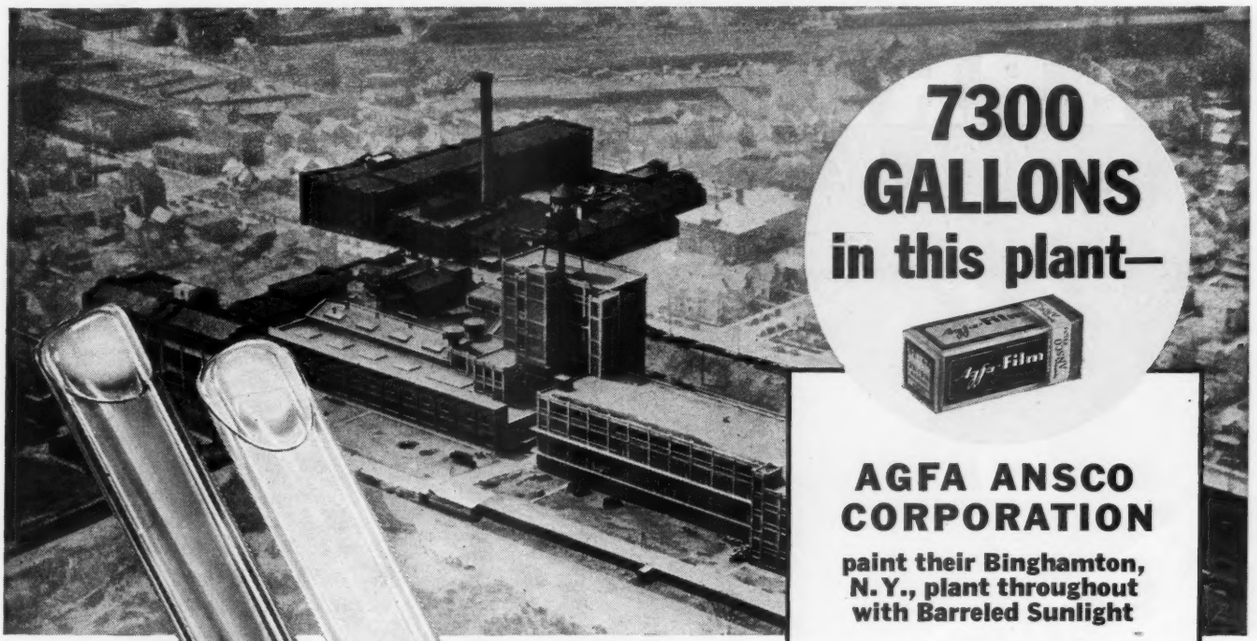
plant superintendent, and the manufacturing committee of the management.

That is the normal procedure. Naturally it takes time. And sometimes, despite a well-executed program of preventive maintenance, an emergency will arise. When it does and the expense involved is more



7300 GALLONS in this plant—

AGFA ANSCO CORPORATION

paint their Binghamton, N. Y., plant throughout with Barreled Sunlight

IN 1928, Agfa Ansco Corporation painted the ceilings and walls of their new film plant, shown in foreground above, with 4800 gallons of Barreled Sunlight. So well was this lastingly clean, white paint suited to the nature of Agfa Ansco work that the following year they painted their paper factory (in background) with Barreled Sunlight, using 2500 gallons. Another proof of the superiority of Barreled Sunlight for industrial interior painting!

THIS VIAL contains refined linseed oil commonly used in white oil paints. The yellow color of this linseed oil disappears when the oil is properly mixed with white pigments. The white paint it makes *looks* white. But don't be fooled! The yellow is still there. Sooner or later it will appear upon your painted ceilings and walls!

THIS VIAL shows how the same highly refined linseed oil, as contained in the first tube, appears after treatment by the "Rice Process." It is almost pure white. This "Rice Processed" linseed oil is the principal reason why Barreled Sunlight remains white, year after year . . . spreads and hides better, flows more easily.

YOUR SURETY

We maintain that Interior Barreled Sunlight Gloss, the "Rice Process" White, will remain white longer than any oil-gloss paint or enamel, domestic or foreign, applied under the same normal service conditions and according to our specifications. If it does not do so, we will give, free, enough Barreled Sunlight to repaint the job.

These Long-Time, Large-Quantity Users, Too

CANNON MILLS CO.
Users since 1914

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Users since 1914

DRAPER CORPORATION
Users since 1919

GORHAM MANUFACTURING CO.
Users since 1908

PEPPERELL MANUFACTURING CO.
Users since 1898

ROCKWOOD SPRINKLER CO.
Users since 1910

W. F. SCHRAFFT & SONS CORP.
Users since 1909

. . . and hundreds of others

WE WELCOME trial comparative tests at any time for whiteness, opacity, ease of application, square footage and length of life, under equal conditions, against any other interior gloss white on the market. Send for free test sample can of Barreled Sunlight. Make your own comparisons or ask us to send an experienced representative. Write U. S. Gutta Percha Paint Company, 2-J Dudley Street, Providence, R. I. Branches or distributors in all principal cities. (For Pacific Coast, W. P. Fuller & Co.)

BARRELED SUNLIGHT

REG. U. S. PAT. OFF.

● Features: 1. Absolute minimum of headroom consistent with safe, durable construction. 2. Direct worm drive. 3. Few moving parts. 4. Totally enclosed. 5. Automatic lubrication. 6. Noiseless operation. 7. Rope or push button control. 8. Anti-friction bearings. 9. Ball bearing trolleys with swivel yokes permit hoist to negotiate curves of small radius. 10. Hoist frame supported by trolley yokes and not suspended from king pin.

Sprague Hoist Division: SHEPARD NILES CRANE & HOIST CORP.
364 South Schuyler Avenue, Montour Falls, N. Y.

He couldn't figure out where the **Fire** *went to*

● **Fire blazed up in the inking rolls of the big newspaper press. The workman pulled a LUX Extinguisher from its bracket and blanketed the flames with LUX gas. The fire was out before he realized it.**

(Condensed from the official report.)

Anyone who first sees a LUX extinguisher in action marvels at its speed in killing serious blazes . . . especially electrical and flammable liquid fires. Experience has taught plant managers that these two are foremost among all fire hazards. LUX extinguishers get these fires out with a maximum of speed, a minimum of trouble and an entire absence of damage or mess.

LUX's extinguishing principle is simple. LUX carbon-dioxide gas expands 450 times, penetrating the entire fire area, even into hidden or remote crevices. Fire cannot live in this atmosphere.

Protect your electrical and flammable liquid hazards with LUX extinguishers. You'll cut fire losses and avoid costly shutdowns. LUX gas is harmless to man or materials. Prices start at $14. For complete information write

LUX **Walter Kidde & Company** LUX
102 West Street, Bloomfield, N. J.

than $100, the regular work order is still required, but the approval of the plant superintendent, or, in his absence, that of the acting plant superintendent, can be taken as authority to proceed with the work. This is only exercised in extreme emergencies.

To insure promptness of reaching a mutually agreeable decision, an engineering meeting is held weekly at which all pending work orders and engineering subjects are discussed.

Getting the Work Done

So much for authority to do the work. Now to get it done.

If it is a simple repair job, the master mechanic assigns the job to the craft foreman in whose province it falls. The foreman assigns it to a mechanic who investigates the job and reports the condition as he finds it, sees what parts or materials are needed, and goes to the stockroom for them, or reports the need to purchase parts or materials not carried in stock.

In a plant that covers so much territory, it would be an easy matter for a workman to spend more time going to a job and coming back to find out about the next one than he spent in actual work. To prevent this, we schedule the work as far ahead as possible. As each mechanic goes off duty at night he knows what his first job will be in the morning, often the first several jobs.

For purposes of cost accounting each workman must charge his time against the job that occupies it. Until recently he could do no job without having in his possession the written order covering it. He also had to have a time card for the job. That worked all right until he finished all the jobs assigned him by the foreman the night before. Then he had either to go back to headquarters for another job order or the foreman had to send a messenger to him with a new order and new time card.

To cut down this lost time, we have lately altered this arrangement. A timekeeper is the key to the new setup. He keeps the time cards and punches them, as the workmen direct by phone, at the start and completion of each job, and instructs them where to go for the next job. When the workman has looked over the job and returns to the stockroom for the necessary materials, it is a simple

Cross-section of Vari-Pitch Sheave and Texrope Belt adjusted for minimum diameter—low speed.
Cross-section of Vari-Pitch Sheave and Texrope Belt adjusted for maximum diameter—high speed.

Announcing

THE *New* VARI-PITCH TEXROPE SHEAVE

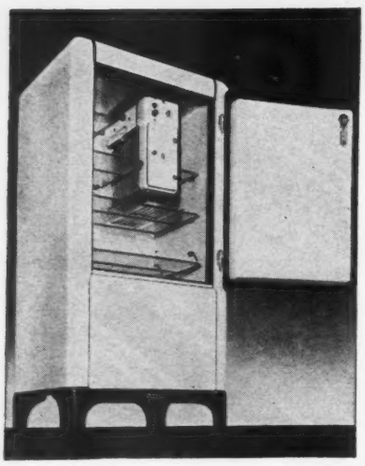
The Allis-Chalmers Mfg. Co. now offers a most important new development in power transmission — the Vari-Pitch Texrope Sheave. ● In this new sheave, by a simple adjustment which takes but a few moments, the pitch can be altered so as to give a variation in speed of from 15 to 25 per cent per sheave; if both sheaves are of this type, the range of variation will be doubled. ● The new Vari-Pitch Sheave permits you to experiment with different speeds to ascertain at just what speed your machinery shows the greatest efficiency; it permits you to take advantage of new higher speed cutting tools; it permits you to make different products, some of which require higher speeds and some lower —and do all this without dismantling and buying new drives, but simply by taking a few moments to make the desired adjustment. ● Vari-Speed Sheaves are made in two types, manual and automatic. The manual type is recommended for applications that require occasional change of speed. For applications that require frequent changes the entirely automatic type is recommended in which speed can be instantly varied to the full range while the drive is in operation.

TEXROPE DRIVES

ORIGINATED BY ALLIS-CHALMERS

ALLIS-CHALMERS MANUFACTURING COMPANY · MILWAUKEE, WISCONSIN

MORE PROOF!



DeVILBISS Equipment Spray-Finishes NORGE Refrigerators

Leading manufacturers find that DeVilbiss Spray-Finishing Equipment is the best means of producing high quality finishes—finishes that enhance their products' appearance and impart added selling appeal. Also, DeVilbiss Equipment speeds up finishing operations, saving time and labor, and reducing costs. These are sound reasons why so many manufacturers have used DeVilbiss Equipment for such a long time.

You will be interested in the latest developments in new and modern DeVilbiss Spray-Finishing and Exhaust Equipment.

THE DEVILBISS COMPANY · TOLEDO · OHIO

New York Philadelphia Cleveland
Detroit Chicago St. Louis
San Francisco Windsor, Ontario

Direct sales and service representatives available everywhere

DeVilbiss

matter for him to step into the timekeeper's office for the written order. This arrangement saves many a trip from some far corner of the plant, relieves the craft foremen of a great deal of paperwork, and enables them to give their major attention to supervising and scheduling which is, after all, their real job.

Certain of our production departments have highly specialized machinery. We have found it advantageous to assign special mechanics to a number of these departments. Such mechanics stay in the departments to which they are assigned and spend all their time checking, adjusting, and keeping the machines in perfect running order.

A running record is maintained in the control division of the engineering department of the costs accumulating to a mechanical work order. The purchasing department sends to the control division a copy of each purchase order drawn for the engineering department. Storeroom requisitions are forwarded through the control division to the accounting department. The time charged on service cards against these jobs is recorded against the job on the control division records. When the total spent on a job approaches the danger point of overrunning the estimate, the engineer in charge of the job is notified. A check-up is made and a report rendered to the plant engineer of the status of the job.

Wasted Heat Warms Nobody

(Continued from editorial page 435)

The thermostat usually is located in the coolest part of the room. In a large area several thermostats may be installed, each being connected to a bank of unit heaters. With this method of control the warmest portion of the building will not become too hot while the coldest part is being brought up to the desired temperature.

Use of thermostats saves heat. It eliminates the tendency to open doors and windows and waste heat, tends to produce a more uniform temperature, does away with hand operation and regulation. When thermostatic control is used, buildings can be properly heated at night

Then the door closes automatically!

FIRE PREVENTION WEEK—OCT. 6-12

Automatic closing . . . . .

that's the certain protection afforded by R-W equipment. The doors *close themselves* at any temperature desired; they cannot fail! Satisfactory operation guaranteed. When closed, FyeR-Wall doors stop the passage of fire.

Lower Insurance Rates

The label of the Underwriters' Laboratories on this R-W equipment entitles you to much lower insurance rates.

Fire Doors Save Millions Annually!

Our special 96 page Fire Door Catalog, No. A-250 describes several types of doors; hardware for sliding, swinging and vertical doors, in both flat and round track types; and cites instances where such equipment has actually saved business districts of cities and many cases where thousands of dollars worth of property has been saved.

Write for Catalog A-250 today.

Richards-Wilcox Mfg. Co.

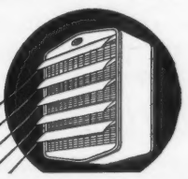
"A HANGER FOR ANY DOOR THAT SLIDES"

AURORA, ILLINOIS, U.S.A.

Branches: New York Chicago Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit Atlanta Pittsburgh Milwaukee Richards-Wilcox Canadian Co., Ltd., London, Ont., Montreal, Winnipeg

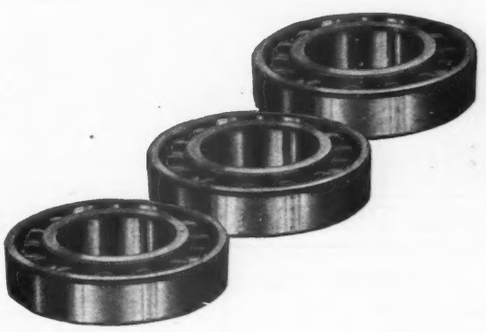
SCHNOZZLE overlooked an important detail when he left his nozzle at the station house. Please don't overlook the high velocity jet of the Herman Nelson hiJet Heater.. Large free area, streamlined tubes and other features of the hiJet's heating element, make possible this principle which assures proper distribution of heat throughout working areas. We would like to send you complete information regarding the proper design and sturdy construction of hiJets. Ask for our booklet "1001 Heating Problems Solved".

HERMAN NELSON **hiJet** HEATERS



THE HERMAN NELSON CORPORATION, Moline, Ill.

Exchange Service Saves 40% ON BEARING REPLACEMENTS



Exchange your old repairable ball bearings—**any type and size**—for Ahlberg Ground Bearings. And appreciate this!—You can save an average of 40%. Write for free booklet "The Story of Ahlberg Ground Bearings" and address of nearest Ahlberg branch.

AHLBERG BEARING COMPANY

321 East 29th Street, Chicago, Illinois

Ahlberg *Ground Bearings*

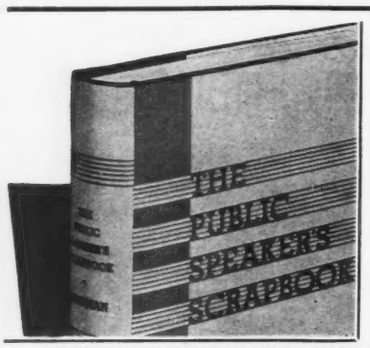
SERVICE PROVEN

DESIGNED FOR LONG LIFE

Specifications for Pittsburgh Chain-Link Fence were developed with due regard for the many hazards to which a fence is subjected. It is designed and manufactured to last a long time and to keep in good condition with a minimum of care. The erection of a Pittsburgh Chain-Link Fence is a permanent improvement of the property. Services of the Pittsburgh Steel Company's engineers in planning and estimating the cost of enclosing your property are gladly offered.

Pittsburgh Chain-Link Fence

PITTSBURGH STEEL COMPANY 760 UNION TRUST BLDG. PITTSBURGH, PENNA.



Now—

Ideas and material *for the* speechmaker

At last, a practical book for the business speaker, giving the principles and psychology of speech building, together with an ample selection of suggested material. Do you know how to get an effective beginning?—inject suspense?—find apt illustrations, serious and humorous?—close forcefully? This book tells.

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THE PUBLIC SPEAKER'S SCRAPBOOK

By **William G. Hoffman**, Professor of English and Public Speaking, Boston University. 269 pages, 5½x8, **$2.50.**

Contents

Dead or Alive?
How to Begin
Finding and Developing Ideas
How to Conclude
How to Introduce a Speaker
How to Improve the Voice
Provocative Paragraphs
Illuminating Anecdotes
Epigrams

For years the author, a widely-known teacher of public speaking, has been searching books, speeches, magazine articles and other sources for the best, most apt, brightest cues, paragraphs, anecdotes, and examples applying to hosts of situations. Here is the best of it, in this big scrapbook for the stimulation and help of others who must make speeches. The book also tells you how to adapt this material, how to use it properly, how to improve the voice. Altogether, a modern, practical manual from which you can get both ideas and usable substance for speeches for all occasions. Send for it today.

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and over weekends and holidays, thus making sure that piping and products will be protected from freezing. Also, since some heat is kept on, the required temperature can more easily and quickly be obtained on the mornings after holidays.

Heating a cold building in the morning is a very slow process, due to the fact that the cold walls and floors, in addition to the air itself, absorb a great deal of heat. Machines and products in storage that have become cold also absorb much heat, a fact often overlooked in the design and operation of heating plants.

The temperature in offices is ordinarily 70 degrees Fahrenheit and in factories from 50 to 60 degrees. Thermostats can be set to cut in the motors of heating units when the temperature falls slightly below these levels and to cut out when these temperatures are attained. When buildings are unoccupied, thermostats should be set to cut in at about 40 and to cut out at about 50 degrees Fahrenheit.

One Do, Four Don'ts

It will also pay to give close attention to the following points:

1. Do not "crack" or partly turn on heating valves. This causes wiredrawing and excessive condensation in units and leads to water hammer, particularly in one-pipe systems.

2. Check all air valves to make sure that they operate; otherwise the heating unit may be partly filled with condensate or cold air, which will reduce its efficiency.

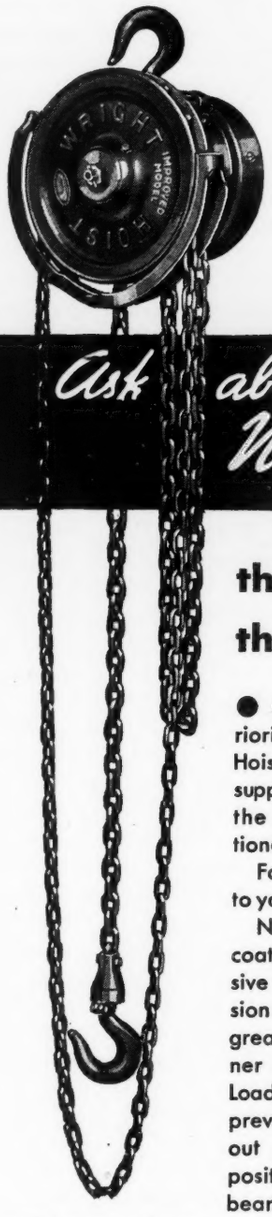
3. Replace all broken window lights; put weather strip on loose or warped sash, ventilators, and doors; close all unnecessary holes in walls.

4. See that air checks on all exterior doors operate properly.

5. Install storm sash and vestibules where possible, especially in office areas. The air spaces so formed have good insulating value.

A simple rule which approximates close calculations of heating requirements in ordinary masonry and wooden buildings can be used when a quick check is needed on the amount of radiation required. It is based on an interior temperature of 70 degrees Fahrenheit with an outside temperature of zero, and allows for two changes of air an hour. To apply this rule:

THE **Wright** Hoist IS THE **right** hoist!



Ask about features No. 1-2-8 & 13!

they emphasize this fact!

● Of the 21 points of superiority in the Wright Improved Hoist be sure and ask your supplier's salesman regarding the four specifically mentioned above.

For these four points bring to you outstanding advantages!

No. 1, refers to the zinc coated finish—a feature exclusive with Wright. No. 2, Precision ball bearings—positively grease sealed with ground inner and outer races. No. 8, Load chain safety guard—which prevents load chain from riding out of pocket regardless of position of hoist. No. 13, Ball bearing spindle which increases efficiency, reduces wear and assures alignment at point of greatest speed.

These four features—plus seventeen others—prove conclusively that the **Wright** hoist is the **right** hoist for general or specific purposes.

If the industrial distributor who contacts you is not in a position to serve you with a Wright, write us regarding your specific problem and we will gladly cooperate with you.

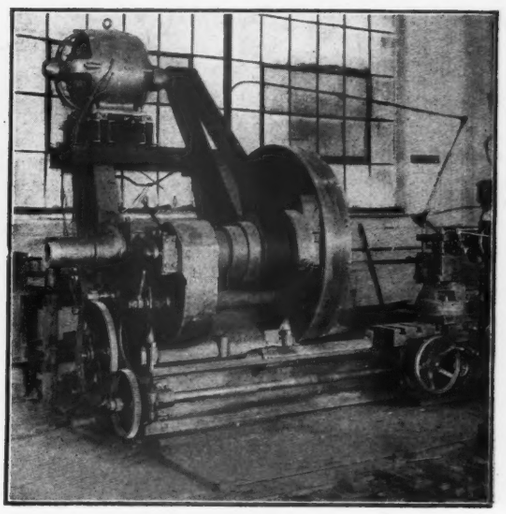
WRIGHT MANUFACTURING DIVISION OF THE AMERICAN CHAIN COMPANY, *Incorporated*
YORK, PENNSYLVANIA
In Business for Your Safety

ACCO

WRIGHT *Improved* High Speed Hoists

RHOADS TANNATE LEATHER BELTING

For Metal Workers



Taking a ¼-in. cut for THIRTEEN years . . . Still on the job

FEW drives are more exacting than this one—a short center, heavy duty lathe, taking heavy cuts at low speed. The lathe is used almost constantly, turning down heavy castings. The Tannate Belt was installed in 1922, and is still in good condition. The superintendent thinks the motor has not been moved back more than 2 inches during the past two years.

Longer life on hard drives, slight stretch and extra strong grip, together with superior resistance to steam, gases, acid fumes and oil make Tannate Leather Belting one of the most economical power transmitting mediums; as many buyers have proved.

It has increased output and saved trouble in many plants.

J. E. RHOADS & SONS
PHILADELPHIA, 35 N. SIXTH ST.
NEW YORK, CHICAGO, ATLANTA
CLEVELAND, WILMINGTON, DEL.

Before winter comes

GO UP AND SEE YOUR ROOF

. . . roof conscious

Thousands of roofs on industrial plants and office buildings will not get through this winter. Roofs have paid one of the most serious prices for neglected maintenance during the last five years.

Go up and see your roof before winter comes. You may be able to take steps which will prevent the need for a complete new roof, deck and all, later on.

If you find something wrong with your roof, have a Koppers Roofer look at it. He may be able to make some repairs that will save you more expense later. And no matter what it needs . . . repairs or re-roofing . . . protect yourself from further trouble by specifying coal tar pitch and tarred felt. There are authentic records of many coal tar pitch and felt roofs with 15 to 40 years of service.

Send the coupon below and we will give you the name of a reliable Koppers Roofer located near you.

KOPPERS PRODUCTS COMPANY
KOPPERS BUILDING PITTSBURGH, PA.

- KOPPERS COAL TAR PITCH
- KOPPERS TAR-SATURATED FELT
- KOPPERS TAR-SATURATED FABRIC

KOPPERS

KOPPERS PRODUCTS CO., Pittsburgh, Pa. F
Send me names of reliable roofers near me.
Send me copy of your Sweet's Reprint which tells how to select roofing materials.

Your Name.....

Firm.....

Address.....

Find the area of all openings in the exterior or cold walls and roof, and divide by 2.

Find the area of all exterior and/or cold surfaces of the building, subtract the area of all openings, and divide by 20.

Find the cubic contents of the total area involved, and divide by 200.

Add these three quotients together. The result will be the approximate number of square feet of radiation required.

For example, assume a one-story building 50x50x12 feet high, with two 4x7-ft. openings; four 6x8-ft. skylights; eight 10x8-ft. sash; and four cold walls. How much radiation will be required to heat this building to 70 degree Fahrenheit, with an outside temperature of zero?

Area of openings is 888 square feet. Dividing by 2 gives 444 square feet.

Area of walls and roof minus area of openings is 4,012 square feet. Dividing by 20 gives 201 square feet.

Cubic contents are 30,000 cubic feet. Dividing by 200 gives 150 square feet.

Adding, $444 + 201 + 150 = 795$ square feet of radiation required.

If the interior temperature is to be 60, instead of 70 degrees, the radiation required will be $795 \times 6/7 = 682$ square feet.

In too many instances the tendency is to neglect heat losses and inefficiency in the distribution of steam for heating because they are not so readily discernible as a water leak or waste of raw materials. However, important losses may, often do, exist. They show up in the fuel bill and cannot rightly be blamed on the engineer or fireman, or on the quality of the fuel.

The place to seek and correct these losses is right out in the plant.

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Questions and Answers

(Continued from editorial page 448)

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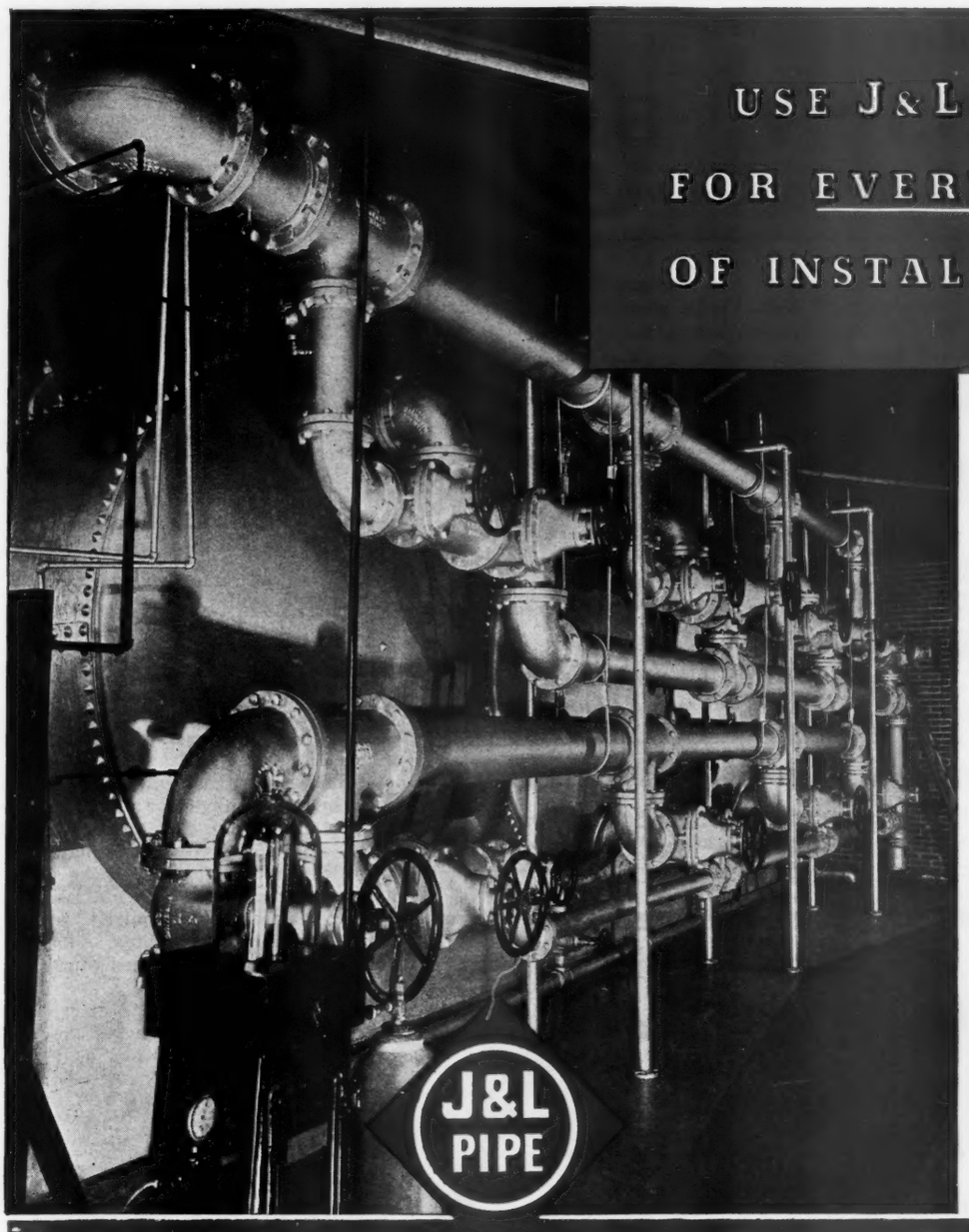
to a reference temperature of 75 deg. Centigrade.

The efficiency can then be calculated from the formula:

$$Efficiency = \frac{Output}{Output + I^2R\ Loss + Iron\ Loss}$$

To determine whether a small transformer will show any saving over the



THE J & L LINE

includes welded pipe to 16"O.D., seamless tubular products to 14" O.D., and hot rolled seamless steel boiler tubes from 1" to 6" O.D. inclusive.

Jones & Laughlin steel pipe is in use in all types of buildings all over the country, and users everywhere testify to its satisfactory performance in all types of installations.

Contractors prefer J & L steel pipe because of its many fine qualities. J & L pipe is made from selected steel. It is free from excess scale. It is thoroughly coated to protect it from corrosion and to assure its arrival on the job in good condition. A special process provides uniform and effective galvanizing. Mill threads are accurate and because of its uniform cutting qualities, similar sharp, true threads are cut easily on the job. Sound, accurately tapped couplings add to the ease of installation. Finally, a rigid inspection system is assurance that the uniform high quality of J & L pipe is constantly maintained. Look to J & L for your steel pipe requirements.

Other J & L *Products*: Bars, Shapes, Plates . . . Structural Shapes, including Junior Beams and Light Weight Channels . . . Boiler Tubes . . . Concrete Reinforcing Bars . . . Fabricated Structural Work.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

NEW TODAY!

VEELOS "V" BELT

will be taken for granted tomorrow

TOMORROW, in America—as in England today—the ability of the new Veelos "V" Belt to lower the cost of power transmission will be taken for granted. Besides having greater efficiency than the average molded "V" Belt, Veelos gives the industrial user a belt adaptable to change of length . . . that will not go out of commission unless more than (at least) two contingent links are broken . . . that can be repaired by the mere replacement of individual links . . . that does not require the use of lacing, splicing or fasteners. The Veelos "V" Belt saves repair and adjustment time—saves storage space (less reserve stock needed) —saves money.

All standard sizes, 3, 4 and 5 link thickness.

Write for further information about this patented link "V" belt.

MANHEIM MFG. & BELTING COMPANY, MANHEIM, PA.

Also Manufacturers of Veelos Balata and Keystone Stitched Belting.

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For Air, Gas and Oil Lines

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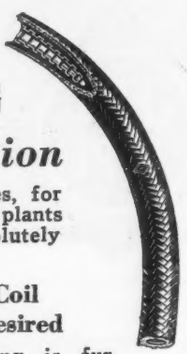
FLEXIBLE TUBING

In Coils for Quick Installation



FOR machine-construction requiring fuel or oil lines, for air-driven-machine-tools, and for gas-operated power plants where vibration is high, flexible tubing that is absolutely leakproof becomes continually more necessary.

Cut from the Coil In Any Length Desired

Imperial Flexible Tubing is furnished in coils, from which any length required can be cut and installed in a few moments, by means of special couplings. Only two ordinary wrenches are needed for assembly.

Made with a Brass Core, Yet Infinitely Flexible

Imperial Flexible Tubing is gas, air, oil, heat and cold proof, yet infinitely pliable. Made with a brass inner core fused to a compound covering, with an oilproof braided fabric outside. Cannot swell or "kink shut."

Installed in a Few Seconds

Cut the tube to the required length, pass it through nut A and compressible sleeve B until it projects a ¼-inch beyond. Pass it into body C, and tighten. The small grommet D forms a hard seat at the severed end of the tube.

Order from your jobber, or write for details to

IMPERIAL BRASS MFG. CO.

519 S. Racing Ave., CHICAGO

present arrangement requires consideration of investment charges, iron loss cost, copper loss cost, exciting current cost, regulation cost.

JOSEPH A. SCHNEIDER
Steubenville, Ohio

One Motor, Two Lineshafts

In laying out a group drive a question has come up as to whether it is better to drive two parallel lineshafts by belting from one to the other, or by using an extended shaft motor, with a pulley at each end. It is estimated that 25 hp. will be required to drive the two shafts, which are 28 feet apart. We do not want to use two motors; therefore, we shall have to use one of the methods mentioned above. Which do you recommend? Why?
K.D.A.—Louisville

USE of an extended shaft motor with a pulley at each end is advisable. Or, by adding a pedestal bearing the two pulleys could be mounted side-by-side at one end of the motor.

This arrangement is superior to cross - belting for two important reasons:

1. The belting cost will be less, since each belt will have to transmit only 12½ hp., assuming that the total load of 25 hp. will be divided equally between the two shafts. If all the power were first transmitted to one shaft a 25-hp. belt would be required between that shaft and the motor. Then a 12½-hp. belt would be needed to connect the two shafts.

2. Direct transmission to each shaft is more efficient. Assuming an efficiency of 98 per cent, when one shaft is driven from the other the efficiency would be reduced to 0.98 x 0.98, or approximately 96 per cent.

M. M. GOOCH
Atlantic Highlands, N. J.

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Trade Literature

(Continued from editorial page 452)

•

rheostat and line switch for plating equipment.—The Udylite Co., Detroit.

FENCE — Folder, on Cyclone 12m fence.—Cyclone Fence Co., Waukegan, Ill.

FLOORS AND ROOFS — Booklet, title "Over the Rough Spots," on methods of keeping floors, roofs, and walls in repair.—Stonhard Co., Philadelphia.

INSULATION—Booklet, title "Barriers to Industrial Waste."—Johns-Manville, 22 E. 40th St., New York.

LAMPS—Catalog, containing sizes and prices of lamps and data on lamp construction.—Hygrade Sylvania Corp., Salem, Mass.

(Continued on page 89)

GET THE FACTS ON SILENT GEARS

Send for this booklet, a catalog and treatise on Celoron Silent Gears. Ask about the new, more resilient, longer lived Celoron "Spoke" Gear — the biggest improvement since silent gears were first made — the gear that really absorbs shocks.

CONTINENTAL-DIAMOND FIBRE CO.

NEWARK DELAWARE

A HIGHLY BENEFICIAL PRODUCT

which holds an unequalled record for effecting economy, efficiency and safety in the operation of machinery and equipment of all types.

Indicated as a Fire Preventive of unquestioned value where friction areas are often fuses to destruction unless controlled.

Manufactured and guaranteed by Pyroil Company, W. V. Kidder, Pres., 806 LaFollette Ave., LaCrosse, Wis., U. S. A.

Look for this signature on every can.

W. V. Kidder
Pres.

(Continued from page 86)

LIFTING DEVICE—Folder, describing "Grip Lifter," a lifting device for use with cranes and hoists. — Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich.

LIGHTNING ARRESTERS—Booklet No. 2, on Crystal Valve lightning arresters. —Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

LUBRICATION—Catalog, on lubrication equipment.—Alemite Corp., Chicago.

LUBRICATION—Leaflet, title "Lubrication of Bearings in Electrical Machinery."—Imperial Electric Co., Akron, Ohio.

MATERIALS HANDLING—Circular 311, showing all sorts of handling methods and equipment. — Lewis-Shepard Co., Watertown Station, Boston.

PAINTS—Two leaflets: one on Rust-Eeter, a protective coating for ferrous-metal surfaces; one on Clo-Rubber Paints, acid- and alkali-resistant paints. —The Harrington Paint Co., Inc., 1630 Cleveland Ave., East Cleveland, Ohio.

PLATING—Folder, showing two plating barrels.—The Udylite Co., Detroit.

PNEUMATIC TUBES—Catalog, showing pneumatic tube systems and equipment.—Standard Conveyor Co., North St. Paul, Minn.

POLISHING WHEEL — Leaflet, announcing polishing wheel made from vegetable fiber.—Divine Brothers Co., Inc., Utica, N. Y.

POWER TRANSMISSION — Catalog 47, on power transmission equipment. — Bond Foundry and Machine Co., Manheim, Lancaster County, Pa.

PROTECTIVE COATING — Leaflet, announcing Triple Life paint protector. —Franklin Research Co., Philadelphia.

PROTECTIVE EQUIPMENT—Catalog on head and eye protective equipment.— Chicago Eye Shield Co., 2300 Warren Blvd., Chicago.

PUMPS — Bulletin W-475-B8, on Double Helical Rotary Pumps, types GS, GR, and GE.—Worthington Pump and Machinery Corp., Harrison, N. J.

ROLLED STEEL—Booklet, title "Rolled Steel for Machine Construction."—Illinois Steel Co., 208 S. LaSalle St., Chicago, and Carnegie Steel Co., Pittsburgh.

SCREW ANCHORS—Bulletin U-100, containing data on construction and use of Rawlplugs.—The Rawlplug Co., Inc., 98 Lafayette St., New York.

SHEARS—Bulletin No. 72-E, covering power squaring shears for $\frac{1}{8}$-in. and lighter capacities.—Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo.

SHOWERS—Catalog, on showers and fixtures.—Speakman Co., Wilmington, Del.

SOUND INSULATION — Booklet, on sound control of mechanical equipment. —Johns-Manville, 22 E. 40th St., New York.

SPEED CONTROL — Handbook, title

HERE'S A

menu

FOR BRUSH HUNGRY MOTORS

- The brush appetites of much industrial motor equipment can be curbed with inexpensive carbon graphites.
- Electro-graphites have greater capacity and no abrasive impurities. Use them for high peripheral speeds.
- The lubricating qualities of natural graphites are necessary with high efficiency equipment. Such brushes must carry heavy loads and surges.
- For low voltage equipment, use metal brushes of low contact resistance. A. C. ring applications are also made from metal group.

For Specific Recommendations . . . write

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12508 Berea Road Cleveland, Ohio

TRICO
REG. U. S. PAT. OFF.
PRODUCTS
will help you maintain plant capacity
OPTO-MATIC
CONSTANT LEVEL
OILER

For ring, ball and wick type bearings.
Saves oil.....
Saves time.....
Ends troubles and burnouts .....
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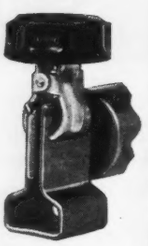
KLIPLOK
REG. U.S. PAT. OFF.
CLAMPS
for FUSE CLIPS

Eliminates burnt fuses and clips.
Reduces blow-outs...
Reduces Watt Loss...
Made in all sizes.



FUSE
PULLERS
"A lifetime of Safety First Service"
Made in 4 sizes

Write for literature
TRICO FUSE MFG. CO.
Department F
Milwaukee, Wisconsin

"Speed Control Handbook." — Reeves Pulley Co., Columbus, Ind.

STAINLESS STEEL — Booklet, on Silcrome, HB stainless strip steel—Acme Steel Co., 2840 Archer Ave., Chicago.

STEAM CONDUIT — Bulletin 352, containing specifications for Therm-O-Tile steam conduit system. — H. W. Porter & Co., Inc., Newark, N. J.

STEAM TRAP — Bulletin T-1720, describing Yarway Impulse Steam Trap. —Yarnall-Waring Co., Chestnut Hill, Philadelphia.

STEEL — Booklet, title "A Century and a Quarter in Iron and Steel," a short history of the Lukens Steel Co., Lukens Steel Co., Coatesville, Pa.

STOKER — Folder, announcing C-E Stoker Unit for boilers developing under 400 hp.—Combustion Engineering Co., Inc., 200 Madison Ave., New York.

SYNCHRONIZER—Leaflet 2202, showing Synchro-Operator for automatically paralleling a.c. generators. — Allis-Chalmers Mfg. Co., Milwaukee.

TAPPING CHART — Chart, title "Per Cent of Thread Chart," for users of tapping equipment. — R. G. Haskins Co., 4636 W. Fulton St., Chicago.

TIRES — Booklet, title "Handbook of Industrial Tires."—The B. F. Goodrich Co., Akron, Ohio.

TOOLS — Catalog No. 35, on line of wrenches and tools.—Bonney Forge & Tool Works, Allentown, Pa.

TOOL STEEL—Catalog, on tool steels. —Crucible Steel Company of America, 405 Lexington Ave., New York.

VACUUM SWEEPER SYSTEMS — Catalog, on cinder reclaiming and fly ash disposal through the use of boiler house vacuum systems.—United Conveyor Corp., Old Colony Bldg., Chicago.

VENTILATORS AND HEATERS — Two catalogs: No. 377-1 on unit ventilators, No. 396-2 on "Speed Heaters."—B. F. Sturtevant Co., Hyde Park, Boston.

WATER TREATMENT — Reprint, title "Zeolites: Mining, Processing, Manufacture, and Uses."—The Permutit Co., 330 W. 42d St., New York.

WELDER — Bulletin No. 309, giving specifications for engine-driven Model SA-200, Type S-3676 welder. — The Lincoln Electric Co., Cleveland.

WELDER—Folder, describing 75 amp. electric arc welder.—Hobart Brothers Co., Troy, Ohio.

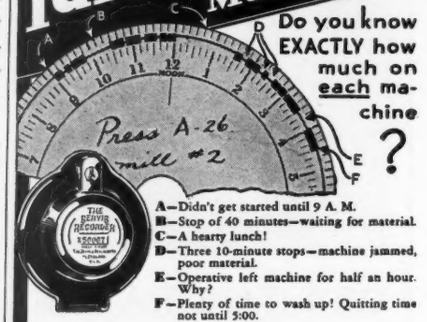
WELDERS—Leaflet, on Ace spot welders. — Pier Equipment Co., Benton Harbor, Mich.

WELDING ROD—Bulletin No. 10, on Amsco Nickel-Manganese Steel Welding Rod.—American Manganese Steel Co., Chicago Heights, Ill.

WIRE CLOTH—Catalog 40-20, covering complete line of wire cloth. — Audubon Wire Cloth Corp., Richmond St. and Castor Ave., Philadelphia.

WIRE NAILS—Catalog, of wire nails and wire products.—Republic Steel Corp., Massillon, Ohio.

Idle Time of Machinery!



Do you know EXACTLY how much on each machine ?

A—Didn't get started until 9 A. M.
B—Stop of 40 minutes—waiting for material.
C—A hearty lunch!
D—Three 10-minute stops—machine jammed, poor material.
E—Operative left machine for half an hour. Why?
F—Plenty of time to wash up! Quitting time not until 5:00.

The Servis Recorder Tells You AT VERY LOW COST

See how "time down" stands out on the chart above. You can't miss it. You can't help but reduce it!

Suppose you could reduce idle time on all your factory machinery nearly 10 minutes a day! What would it amount to in a year—or even a month! More than you'll ever save by "little economies."

This little "time clock for machinery," the *Servis Recorder*, bolts or clamps right on to the machine itself—no ink, no pencils, no electric wires. Send for folder, "A Busy Plant."

THE SERVICE RECORDER COMPANY
1422 Euclid Ave., Cleveland, O.

THE SERVIS RECORDER
The "Time Clock" for Machinery

Do You Read a Routed Copy?

If you are on a route list to read Factory Management and Maintenance, you probably pass it along without having the chance to read just the article that you would like best. Routed copies have a knack of arriving at inconvenient times—late—and often in poor condition.

Why not have your own copy delivered to you each month? Then you could read at your leisure—and while the news is still hot. A subscription costs only $3.00 per year. Send in yours now.

FACTORY MANAGEMENT *and* MAINTENANCE
330 West 42nd Street, New York City

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW
Editor

Industry Must Pay the Bill for Skilled Workers

MOST of the evidence available is to the effect that there is a shortage of skilled workers. The principal statistical evidence is a report of the National Industrial Conference Board, indicating that in the metal working industries the shortage is now being felt, would be acute if the plants were working at normal capacity.

But a convincing case can be built without statistics. Consider the influences that have been at work for several years.

First, the very conditions that are responsible for our present high standard of living have reduced the supply of skilled workers. We refer to the constantly extended use of automatic and single-purpose machines, and the method of manufacture that involves the breaking down of tasks into very small units. Formerly all-around workers were common; today few of them are developed.

Second, casualties in the ranks of the skilled workers have not been replaced during the depression. If the commonly accepted estimate of an annual mortality of 5 per cent is correct, our situation now must be much worse than it was in 1929, when practically all skilled workers were employed.

Third, because no skilled jobs were available, many skilled workers went into other occupations. Some of them are better satisfied in their new work; others have lost their skill in large measure, even though they would prefer to return to skilled jobs.

Fourth, restrictions upon immigration have shut off what was formerly a worthwhile source of recruits for the ranks of skilled workers.

There are two things to do to replenish the supply of skilled workers. One is to train apprentices. The other is to train present workers to higher levels of skill. Apprentice training is a long-time program. Training of present workers is for immediate results.

There are many variations in apprentice training. A thorough job of study and planning should be done by the individual plant and by the industry concerned before a program is embarked upon. Records of experience are available.

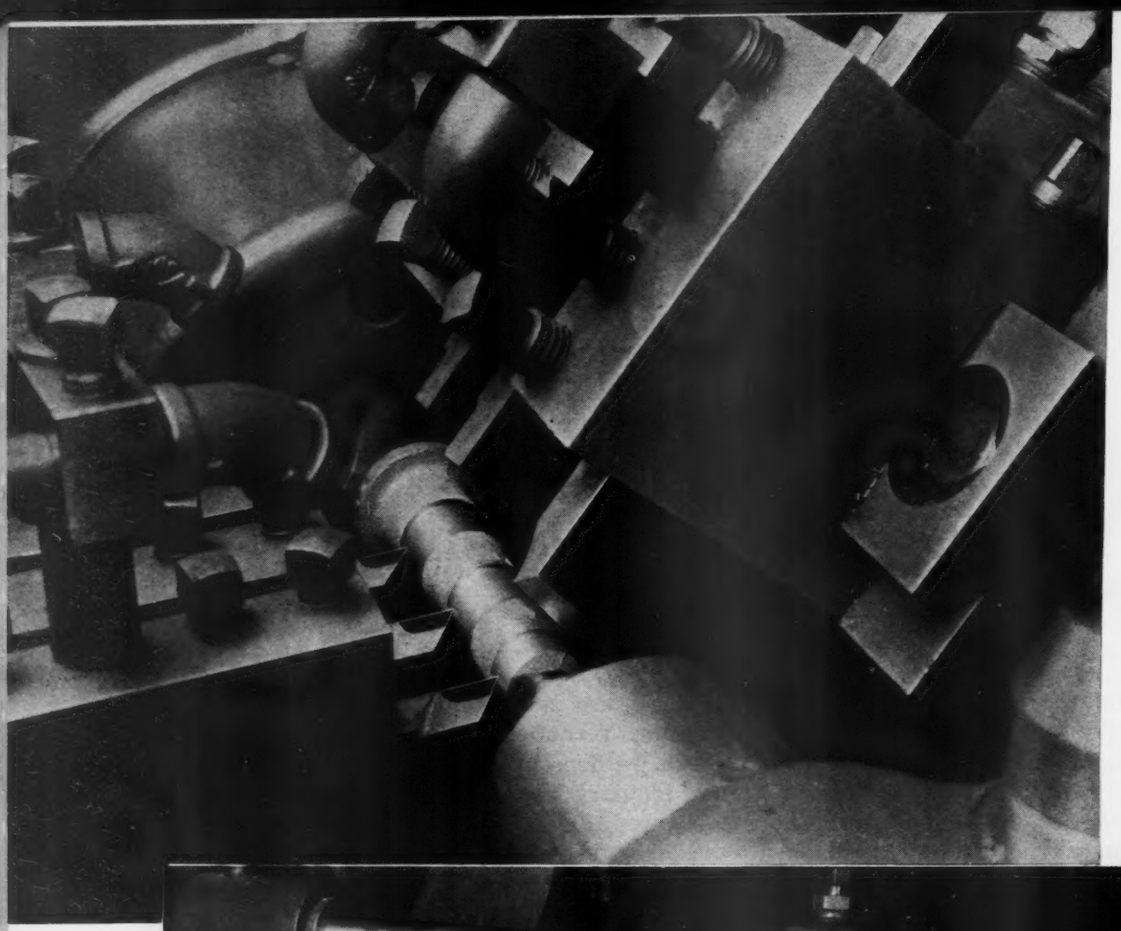
In training present workers, a plan that can be recommended to individual plants provides for training workers now in the top level of skill to do the jobs requiring most skill, training the workers in the next level of skill for the jobs to be vacated by the higher class, and so on. It is step-up training.

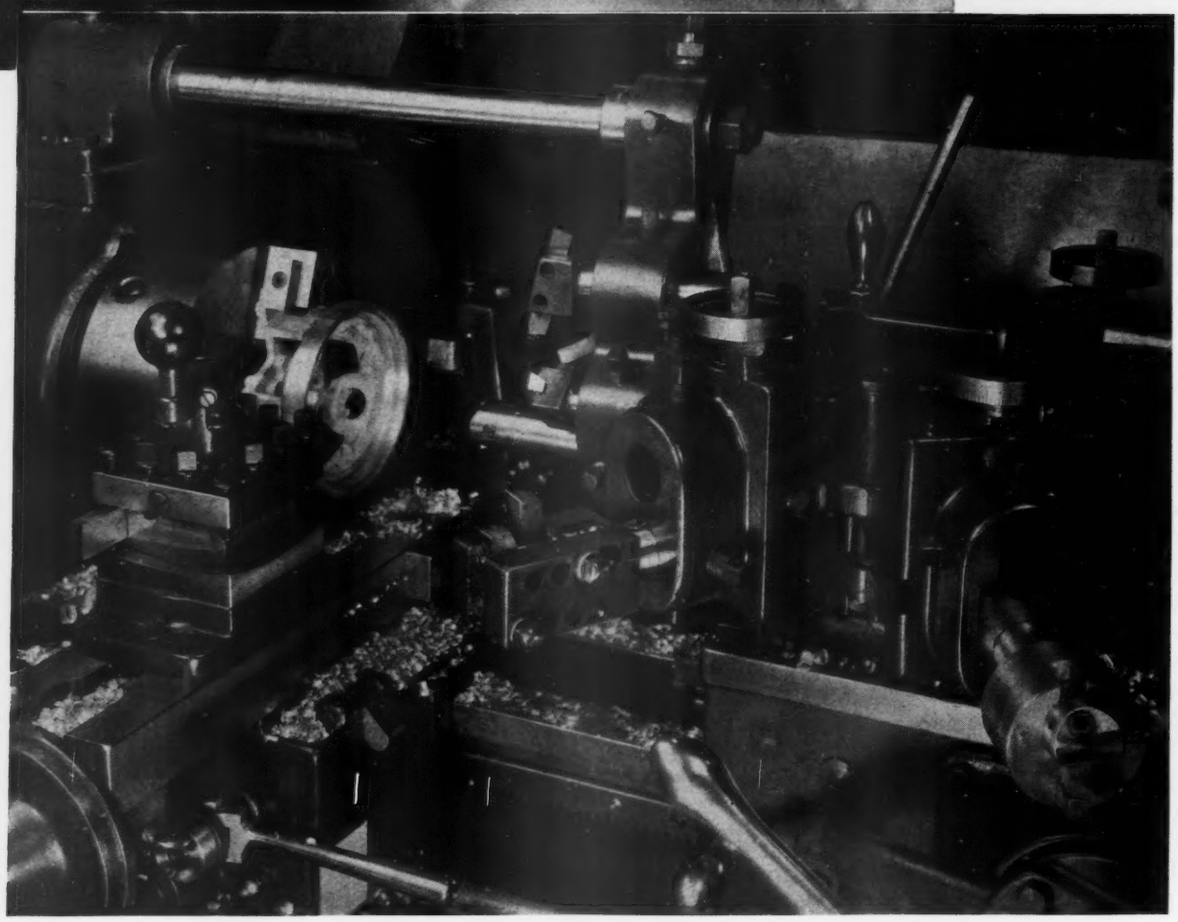
No matter what plan, or combination of plans, is followed, results will be unsatisfactory unless the wage reward is made attractive both during and after training. The pocketbook counts with the apprentice and with the journeyman just as it does with all of us. A slim purse kills much ambition.

Four years look like a long time to the beginner. Why should he go along for that length of time on short rations while his friends are drawing down fat envelopes on unskilled production work? And why should the average worker "advance" to skilled work when he knows that the full-fledged skilled mechanic is getting but little if any more than the good single-operation worker on incentive?

LIKE almost all problems faced by industry today, this one boils down to the need for action on the part of management. Cooperative action among groups of plants—in cases by entire industries—is preferable. If it can't be had, individual plants then have the job to do.

From now on much will be heard and read about training, particularly apprentice training. We urge a receptive attitude during the period of study and planning, followed by action when the objective is established.





Above, a Jones & Lamson V-automatic turns and faces 150 cast-iron bolster cases every hour. Below, a Warner & Swasey turret lathe turns, faces, and bores an aluminum alloy part every 2½ minutes. Both use Carboloy cutting tools . . .

Machines and tools enable the user to take advantage in full measure of the technological development necessary in manufacturing at costs low enough to bring about increasing sales

A Race for Safety

Translates excitement of horse racing to task of making the plant a safer place to work in

HENRY J. ROESCH
Director of Industrial Relations
Briggs Manufacturing Company, Detroit

SUPERVISING the safety program of a company that has 203 operating departments scattered over five plants in widely separated sections of the city and under the direction of 39 divisional superintendents or general foremen, is a real responsibility. The fact that there are over 1,300 punch presses in the various plants, ranging in size from a chute-feed inclinable-back press to some of the largest triple-acting presses ever built, makes the job no easier.

It is hard to be in a hundred places at once; the most a staff officer can do is to sell the line executives on safety's being a big part of their job. We should like to go around every day and give every man in the shop a talk on safety, but can't cover 30,000 men in a day. So we have to use mass methods.

There is hardly a plant that has not put up safety posters on its bulletin boards. Many of them show brutally realistic accident scenes, missing fingers, gruesome burns. They are supposed to shock a worker into a vivid realization of what a careless moment of inattention may mean. Workers get inured to dangerous environments, however, and begin to accept as commonplace situations that to the casual visitor look extremely hazardous.

Experiment in Applied Psychology

Figuring on the possibility that the men might get just as callous to safety posters, we tried an informal experiment in applied psychology one noon a few months ago. The men were lining up to buy sandwiches and coffee at one of the portable food trucks we have in the plant. As they fell into line, we buttonholed a number of them at random and asked this question:

"Can you tell us, without turning around to look, what the picture on the safety bulletin board is all about, and what the slogan is directly underneath it?"

Try this stunt, and see what reaction you get. Only a few of the men could even faintly recall the picture, which showed a man falling off a window ledge, his safety belt dangling behind him. No one could recall the slogan: *Use the safety devices that are given you.*

In other words, the reader interest of these posters was a minus quantity. Yet the company had been spending a lot of money to keep its hundreds of bulletin boards freshly stocked with horror pictures.

Not long afterward I went to a horse race. With the memory of that exciting event in mind, it occurred to me that were it possible to capture only a fraction of the wild enthusiasm of the crowd as the horses came into the home stretch and apply that enthusiasm to an ac-

cident campaign, we should soon have the safest plant in the world.

How to create some of that enthusiasm was the problem. Finally the logical answer came: Base a safety campaign on the competition of a horse race.

On Tuesday, October 8, the employees and supervisors in the Briggs Detroit plants started off on the most extensive accident prevention program in the company's history. Brightly colored boards that represent racetracks are placed at vantage points in the five plants. Fastened to the tracks are miniature horses and jockeys. Each horse bears a number and has a distinctive color combination that represents a division in the plant. Each division is made up of a number of departments having similar hazards and working conditions.

At the Highland Park plant, for example, there are eleven divisions, each represented by a horse. At the main plant on Mack Avenue there are thirteen horses in the field. The fifteen divisions spread among the three smaller units are all represented on a single board. In other words, there are three races on—two of them intra-plant, one inter-plant.

They're Off!

The horses were lined up at the starting post the first day of the race. For each lost-time accident that occurs in a department, the horse representing that division stands still on the track for one day. The only way a horse can advance is for the division to stop accidents. The race will be run for approximately sixty calendar days or until the first horse crosses the finish line.

A great deal of study was given to set up a fair handicap for each division. Types of work and working conditions were studied, as well as hazards. The accident experience of each department for the first six months of 1935 was established. Number of employees at the peak period was figured on a percentage basis by divisions. Number of accidents was analyzed in a similar way.

Thus it was found that the most hazardous department was maintenance, because it had 6 per cent of the accidents, although carrying only 3 per cent of the workers. The press divisions at Highland Park and Mack Avenue are almost equally hazardous, although the former division had operated for seven months without a lost-time accident. These divisions received the largest handicap of seven days; that is, a man has to remain away from work for at least a week before his accident is counted against the division as a lost-time accident. On the other hand, the stores division, which has not as many men and hazards, is allowed only one day.

These handicaps have been accepted without argument, because they are based on a statistical analysis. The fact that the analysis was broken down by divisions was helpful in itself, since it called attention to exposure factors in each sector.

Above the race course is space to list division titles, names of jockeys, and handicaps. The jockey is the divisional superintendent or general foreman, except in one of the smaller units, where the plant manager is the jockey. Although the chief competition is among divisional heads, the object of course is to have them urge on their supervisors, who in turn will pass on the enthusiasm directly to the men. As a matter of fact, even before the races started, several of the divisional superintendents called a meeting of department heads and laid down the law as to what was required in the way of cooperation.

We have a live crowd of line executives; it is anticipated that side bets will increase the natural competitive instinct to excel.

Eight racetracks are now in use—three at Highland Park, two at the main plant, and one each at the smaller plants. They are placed in conspicuous places near the exits, so that they can be seen on the way out. They are well illuminated with showcase fixtures.

Horses will be moved according to daily reports from the first aid department. Once a week reports will be checked to make sure no errors have crept in to affect the relative standing of the horses.

To stimulate interest in advance, the boards were made within the plant. A young man in the engineering department did the art work; from his original drawing, templets were made so that solid poster colors could be applied with an air brush. The boards are made of 18-gage steel, approximately 5 by 8 ft., framed in wood. In the racetrack portion, 960 holes have been drilled, and behind this area is a sheet of cork, about $\frac{1}{4}$ in. thick. The sheet brass horses are mounted on hinged back pins which are stuck through the holes and held in the cork backing. A die was used to stamp out the horses, which were also painted in three colors—one for the horse, one for the jockey, and the third for his number.

Later on it is intended to supplement the big boards with small departmental signs calling attention to the relative standing of the horse representing the particular division.

The period in which this safety scheme is being tried out is a crucial one. It is a period of rapid build-up in number of employees at the beginning of the new-model season. At the start of the race there were 12,000 workers on the payroll; at the finish there may be 30,000. A lot of green help must necessarily be drawn into the plant. Extra vigilance must be observed.

To Win Is Not the Real Goal

The goal is not so much to win the Safety Sweepstakes as it is to minimize the human grief and suffering caused by a moment of daring or forgetfulness. We must make it our business to stop the other fellow from taking a chance. We must try to eliminate that moment of forgetfulness when a man's mind is not on his job. We must caution the old-timer who has worked at his trade so long that he has only contempt for hazards. We must train the new employee so that he is aware of the hazards surrounding him.

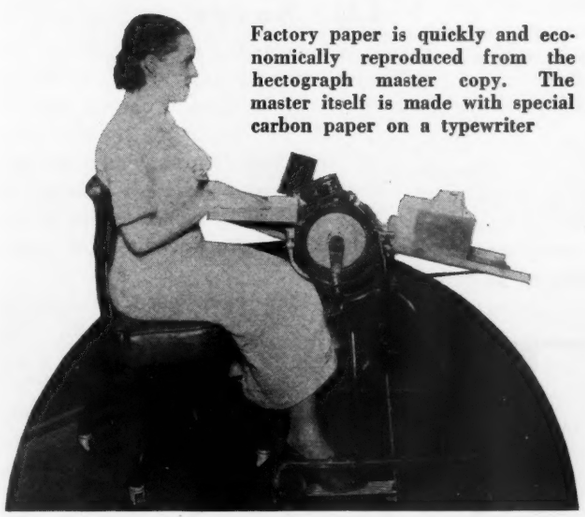
In other words, every individual must be on his toes to see that neither he nor his fellow is the victim of a careless act. If this is done, the Sweepstakes will make safety not just a word, but an actuality in the Briggs plants.

Now the Fluid Hectograph

New machine makes as many as 250 copies of the factory order; hectographing of repeat orders from original master is practicable

THOMAS M. LANDY
Manufacturing General Department
General Electric Company, Schenectady

BASIC tool of any production planning and control system is the individual order, sometimes referred to as the component part order. Hence the preparation of this order and the accompanying factory forms is one of the planning section's biggest problems.



Factory paper is quickly and economically reproduced from the hectograph master copy. The master itself is made with special carbon paper on a typewriter

For one-time use, hectographing has always been the most economical method of preparation, but for the handling of repetitive orders it was costly, because each time an order came through a new master had to be prepared. There was also a definite limit to the number of legible copies that could be made from one master. For these reasons many factories have turned to the use of plates and stencils on which all constant information is permanently set up and only the variable information has to be changed each time a repeat order is received.

With the perfection, however, of the so-called "fluid hectograph" it is now possible, within certain limitations, to obtain results heretofore only possible with plates and stencils. It is done by setting up a 3x5 hectograph master (Figure 1) similar to the master stencil used in the mechanical method of paper preparation.*

The procedure for making the hectograph master is simple. The first line contains the variables; the rest of the master contains the constant information. The master is placed in the typewriter backed by a strip of special carbon paper. The impression on the face of the master is in regular ink, but the carbon paper causes a deposit of special duplicating ink on the back. If desired, the master may be prepared in whole or in part by longhand by the use of any medium hard pencil.

For economical and convenient handling, masters are furnished to the typist in "gangs" of five. Five individual masters are therefore typed with one set-up in the typewriter. The strip of masters is then separated into its five component 3x5 units. After being checked, the masters are routed to the duplicating machine, on which the sets of factory order copies are then reproduced.

Figure 2 shows a typical set of factory copies made from the hectograph master. The number of copies per order depends of course upon the number of operations to be performed, as indicated by the constant information on the body of the form. In some manufacturing divisions the average run is only 9; in others it is as high as 27 copies.

In view of the fact that the master itself is not sufficiently rigid for filing purposes, an extra copy is reproduced on a 6x5 card folded in the middle to serve as a filing pocket. This file jacket (see Figure 1) containing the master is filed by drawing number.

For Repeat Orders

When a repeat order is received, the corresponding master is pulled from the files. The top line of the master, which contains the variable information, is cut off, and the new line of variables applying to the repeat order is typed on the top line of another of the regular master forms. The new variable master

*For a complete description of the mechanical method of preparing factory paper, see "Production Control," Thomas M. Landy, May, 1933, page 195.

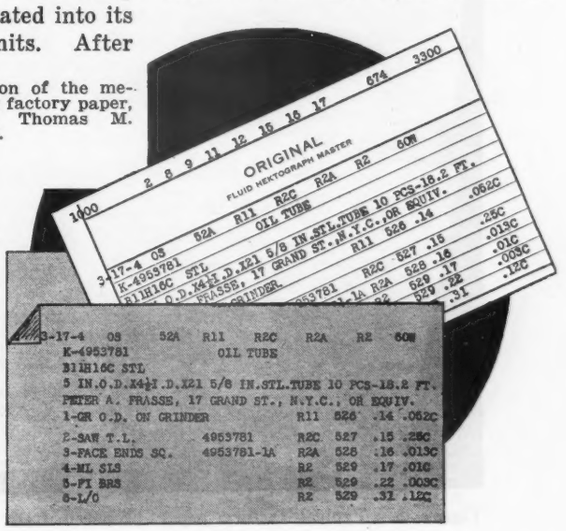

ORIGINAL
FLUID HECTOGRAPH MASTER
3-17-4 OS 52A R11 R2C R2A R2 60M
K-4953781 OIL TUBE
B11H16C STL
5 IN.O.D.X4½I.D.X21 5/8 IN.STL.TUBE 10 PCS-18.2 FT.
PETER A. FRASSE, 17 GRAND ST., N.Y.C., OR EQUIV.
1-GR O.D. ON GRINDER R11 526 .14 .062C
2-SAW T.L. 4953781 R2C 527 .15 .28C
3-FACE ENDS SQ. 4953781-1A R2A 528 .16 .013C
4-ML SLS R2 529 .17 .01C
5-FI BRS R2 529 .22 .003C
6-L/O R2 529 .31 .12C

Figure 1. Master copy of factory order and folded card jacket in which it is filed. When repeat orders are received, the variable information (top line of master) is cut off, a second master containing only the variable is prepared, and from the two, as described in the text, the required number of factory copies is reproduced

and the original constant master are then matched together at the lower left-hand corner and attached to the drum of the machine. The new variable master is placed above the original constant master, but, inasmuch as the top panel of the original master has been cut off, the new line of variables is exposed for duplication and is in correct registration with relation to the constant data.

As soon as the factory order copies have been reproduced, the variable master is discarded and the constant master is reinserted in its file jacket and returned to the files. This procedure is continued as repeat orders are received, until the constant master is no longer capable of reproducing satisfactory copies.

It has been found that the fluid hectograph machine will produce approximately 250 copies when the constant master is used intermittently over a period of months. The number of orders, therefore, for which one of these masters can be used, varies with the number of copies reproduced each time.

The fluid hectograph is faster than the plate method because it takes less time to type masters than to cut plates. Furthermore, the line of variables can be typed about as quickly as the numbering wheels can be set on the printing machine. The reproduction rate is about the same on each machine.

Up to a certain repetitive point, then, the fluid hectograph machine performs the same function as the stenciling equipment, but at a greatly reduced capital investment and with a substantial saving in operating expense. Also, because of the high initial cost for the stencil set-up, it has been customary to centralize the work of preparing factory paper. This practice has to some extent hampered those manufacturing divisions that are located in buildings far removed from the central section. Close control of factory orders under such conditions is more difficult to attain, and on occasions production is even delayed.

With the new method, however, it is possible to decentralize the preparation of paper as much as may be necessary. Wherever advisable, divisions may now be supplied with fluid hectograph machines and thus perform and control every operation incident to the handling of an order.

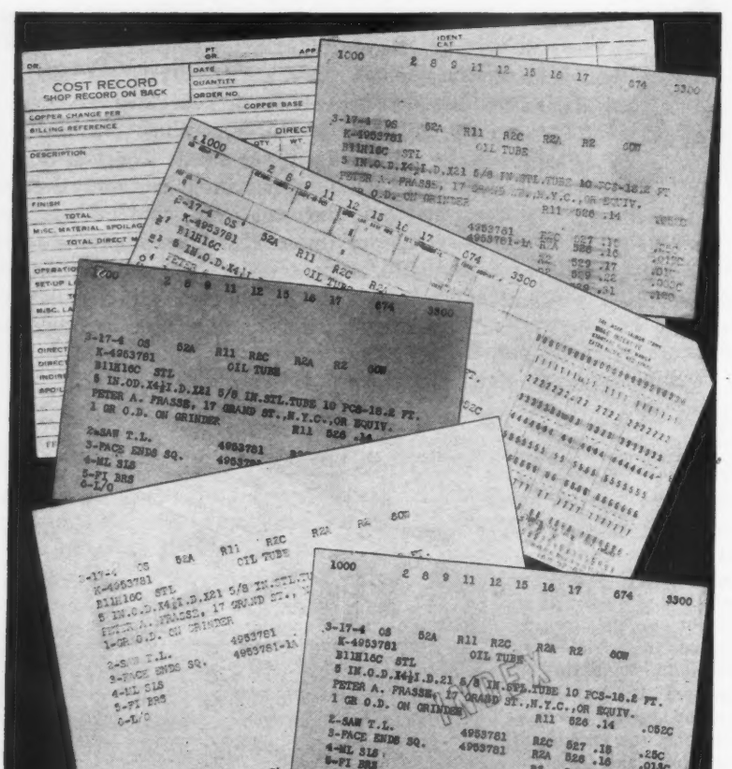


Figure 2. Typical factory paper prepared from the hectograph master

Life Saver

SOMETHING on the order of the Congressional Medal of Honor is Armco's Distinguished Service Medal. Ten years ago the American Rolling Mill Company inaugurated the practice of giving it to men who have, by quick thinking and acting, helped to save the lives of fellow workmen.

Six men have been so honored. Latest is Albert Creekbaum, crane follower in the Middletown Plant. He stopped a runaway crane whose operator had fainted, saved not only the operator but also three other workmen who were eating their lunch in its path. In the photograph, Creekbaum accepting the Distinguished Service Medal from Charles R. Hook, president of the company.

•

Code for Toxic Dusts

EMPLOYERS who have to contend with occupational diseases will applaud the American Standards Association's recent decision to set up a National Advisory Committee on Toxic Dusts and Gases. Thus for the first time there is a group to which industry can turn for authentic information regarding safe and unsafe working atmospheres. The Committee will assist the various ASA sectional committees in establishing threshold limits on poisonous dusts, fumes, and gases. Members will include specialists in toxicology, pathology, and medicine, also industrial chemists and engineers.

Show Us Men With Hobbies

And chances are you've also shown us good workmen. That's the very practical aspect of Toledo's annual industrial exhibition

YEAR AGO this past summer Toledo Scale executives sponsored a Hobby Show for company employees. Held in the Toledo Museum of Art, it attracted 252 entries, was so successful that the Foremen's Club of Toledo decided to take over the idea, open the show to all Toledo workers, make it an annual event.

Thus the First Toledo Industrial Handicraft Exhibition, June 9 to July 15. More than 900 workers showed samples of their homework. Museum attendance totaled 11,500.

Important to note is the change from *hobby* to *handicraft*. Idea was to bar such hobbies as stamp collecting, limit exhibits to things of more direct interest to industry—things made with the hands.

Interest displayed was a tribute to the skillful management of the project. In no way did companies try to coerce workers. Every entry was voluntary.

Obvious questions are, why a handicraft show? Why should management encourage hobbies?

Answers are nearly as obvious. Nothing breeds discontent quite so much as "nothing to do." Discontented workers cannot put forth their best efforts. Will not. Wage earners have little slack in their budgets for outside entertainment. Yet many of them, even when left to their own devices, develop outside interests that are worth while and do not cost much.

Homework. That Increases Skills

Often they are interests that gee nicely with their work. Woodworkers are likely to work in wood, metal workers in metal. Women may be expected to devote their spare time and energy to needlecraft of one sort or another. Most of the homework, in short, is more often than not of a nature that will automatically serve to increase the skills required in the performance of their daily jobs.

Does it not follow that both employers and employees benefit if these pursuits are subtly stimulated?

Results of a hobby show like Toledo's are more intangible than concrete, hence are difficult, though far from impossible, to evaluate. For instance:

1. The character of the exhibits is tangible proof of the presence of a large group of skilled workers in Toledo. Employees for the first time had a chance to parade their abilities. Hitherto unsuspected talents were uncovered. In several specific instances, workers were promoted or shifted to more suitable jobs.

2. Outside interests of workers are largely along the lines of their daily work. See the accompanying analysis of the exhibits.

3. Hobbies may have a dollar value. One Toledo workman is riding around in a new car purchased out of profits on a furnace control he invented. At least nine inventions among the hundreds of handicraft exhibits show definite promise of being worth real money some day to their creators.

Hobbies are good for employee morale. One concern makes certain tools available during off-hours, cooperates with local vocational schools, has even gone so far as to help employees get their inventions patented.

Toledo Industrial Handicraft Exhibition
Analysis of Entries

Classification	Total Exhibits	By Men	By Women
1. Plane and boat models	45	45	...
2. Machinery, tools, metal craft	88	88	...
3. Painting, etc	199	165	34
4. Photography	42	41	1
5. Needlework	182	3	179
6. Poetry	1	...	1
7. Taxidermy	10	10	...
8. Woodwork	197	196	1
9. Fishing	4	4	...
10. Bookbinding	1	...	1
11. Glasswork	14	14	...
12. Miscellany	93	48	45

Bonus for Inspectors

This concern sets base rates from standard time elements, has to time-study only one in ten of some 1,200 piece parts inspected

E. E. COOK
Industrial Engineer
The Coleman Lamp & Stove Company
Wichita, Kan.

THE COLEMAN LAMP AND STOVE COMPANY
TIME STUDY OBSERVATION SHEET

Workman's Name Carrie Hartman	Machine Bench No.	Part No. 940 - 212	
Workman's No. 521	Type	Part Name Generator Tube	
Workman's Name	Spindle Cone 1234 Driver		Operation No. 22
Workman's No.	Speed 4321 Driven	Operation Name Inspect	
CLASSIFICATION OF WORKMAN	Automatic Screw Machine Data	Dept. Name Inspection	No. 16
Sex F	Gear on drive shaft CAMS	Material	
Fast %	1st Gear on stud	Seamless Steel Tube	
Average ✓	2nd Gear on stud		
Slow %	Gear on worm shaft	Size of Part 1/2 O.D. x 10 1/2" x	

OPERATION ELEMENTS	1	2	3	4	5	6	7	8	9	10	Average	Standard
		15		168		334		540		748		
Pick Up Handful 10 Pcs.		15		16		11		18		15	15	
		25		204		362		573		772		
Visual First End - Thrds - Seats		10		36		28		43		24	26	
" Finish Splits		73		240		406		640		811		
		48		36		44		57		39	44	
" Second End - Thrds		93		265		447		668		844		
		20		25		41		28		33	28	
Gage - I.D. Plug #309 - 2%		107		277		461		677		854		
		14		13		14		19		10	14	
" Length Snap #97 - 10%		146		316		511		726		889		
		39		38		50		39		35	38	
Stack in Tote Pan		152		323		322		733		903		
		6		7		11		7		14	7	
Defective											172	

STANDARD ALLOWANCES			Standard Set Up			
Incentive Factor		20 %		Total Operation Time	.172	Min.
Male/Female Personal Factor		5 %		25% Standard Allowance	.043	"
		%		Standard Operation Time	.215	"
		%	Hours 275			
		%	Machines Per Man	Standard Production	.36 Hours Per C	
Normal		%				
Moderate	Recuperative Factor			Observer's Name W. L. Rowe	Date 8-14-34	
Excessive				Checked by	Date	
Abnormal				Approved by E. E. Cook	Date 8-14-34	
TOTAL ALLOWANCE		25 %				

Piece No. 940-212 Oper. No. 22

Figure 1

FIRST step in setting bonus rates for a group of inspectors in our plant was the determining of standard elements. After a preliminary survey, a set of elements was selected as the natural breaking points in taking time studies. This breaking of the inspection operation into elements is important. It is from the careful break-up of many studies on different parts that we obtain standard times of all elements. If we don't use the same breaking points, our results will be too erratic.

Over 100 time studies (Figure 1) were made of a variety of piece parts to get the standard times. These standards may not be directly applicable in other factories, but the method is adaptable.

A list of the standard elements we found most practicable for our class of work, with a brief description of each element, is given in the accompanying table.

When ready to make a time study, we select and arrange any combination of these standard elements in the sequence that best suits the job and proceed with timing in the regular way. The study is worked up as usual, but as a rule we do not use it for the base rate at this time. We arrange and classify the results on a summary sheet (Figure 2), where the standard elements are listed and the various times (from a variety of work) are accumulated. At least 30 studies are necessary to get workable results and a fair check. We study the most frequently used parts to insure proper rating.

When sufficient studies have been made, it is then possible to set the standard time for each element. We could easily use an average of all the times of an element, but the better method is to cast out items that show excessive time and work toward the minimum.

We next build up standard unit hours per hundred for each standard element and standard time. We usually allow a 20 per cent incentive and a 5 per cent personal factor, a total of 25 per cent which is added to the standard time and converted into unit hours per 100 for each ele-

Standard Time Elements

1. Handling	Where parts are picked up and inspected singly
2. Handling	Where parts are picked up in handfuls and compared with one another or a sample
3. Even Up	For long parts requiring a preliminary sorting and evening
4. Visual	Where inspection is visual on single parts
5. Visual	Where inspection is on a handful at one time.
6. Visual	Where long parts require inspection at both ends
7. Visual Finish	Where minute holes, pits, and cracks cause trouble
8. Pick	Where chips are hard to remove and each piece is handled separately
9. Pick	Where chips are easily removed and a handful is inspected at one time. Also, for using pick as a gage
10. Gage-Plug-Dial-Snap	Where more definite gaging is required
11. Gage-Thread-Loose	Where commercial fit threads are sufficient
12. Gage-Thread-Tight	Where gas-tight threads are required
13. Ream-Motor	For motor reaming and burring
14. Ream-Hand	For hand reaming and burring
15. Burr	For removing burrs other than pick or reamer
16. Blow Out	For blowing chips out of valve bodies
17. Count-Card-Stock Up	For all parts except those under 0.030 standard time
18. Tools and Prints	When inspector must leave for tools or prints

STANDARD ELEMENTS				STD TIME	Insert Bushing 69-07	Burner Tip 71-923	Gas Tube 118B142	Tip Cleaner Body 118A307	Air Tube 118B104	Valve Body 151-607	Valve Stem 132-614	Valve Body 220B607	Stem & Wheel 216-250	Control Rod Head 940-606	Gen. Tube 324-242	Valve Stem 475-214	Valve Body 900-607	Check Body 228-507
Handling			S	.036		.030				.031		.023		.062	.045		.040	.020
"			H	.012	.018		.009	.018	.007		.022		.012			.018		
Even Up			H	.011					.007		.011				.012			
Visual			S	.046		.030				.053		.041		.031	.060		.050	.060
"			H	.016				.035	.011		.008					.030		
"			L	.028						.027						.027		
"			F	.030					.065		.016				.024	.036		
Gage - P-D -			S	.048	.034 .035		.047 .159		.040	.027 .035		.024	.036	.076				
"	Thread		L	.060										.063				
"	"		T	.155						.140 .154								.280
Pick			S	.065					.065	.071								
"			H	.030				.020									.040	
Ream			M	.060									.046					
"			H	.078								.097						
Burr			H	.049		.050	.040		.026	.127					.050			.034
Blow Out			S	.042				.027		.044		.036	.044					.021
Count - Card				.010	.007	.002	.004	.006	.003	.017	.003	.005	.012	.013	.023	.009	.004	.005
Tools - Prints				.005														
Total Oper. Time					.080	.112	.289	.116	.164	.786	.060	.226	.150	.245	.214	.120	.134	.420
Allowances				25%	.022	.028	.065	.029	.041	.196	.015	.056	.037	.061	.053	.030	.033	.105
Std Time					.111	.140	.324	.145	.205	.982	.075	.282	.187	.306	.267	.150	.167	.525
Pieces per Hour					540	420	180	410	290	60	800	260	320	180	220	400	350	80
Hours per C					1.85	2.33	.54	.24	.34	1.66	.13	.38	.31	.54	.45	.25	.28	1.26

Figure 2 (above)

Figure 3 (below)

INSPECTION INSTRUCTION CARD

PART NAME Burner PART No. 1171219

INSPECTION DEPT. #16 DATE 8-14-34 FORMULA BASE 0.42 HOURS PER 100

INSTRUCTIONS	GAGES	%	STD. ELEMENTS	HOURS	PER C
1. Pick up Singly		100	Handling — Singly	.0076	0760
			" — Handful	.0036	
			Even up — "	.0084	
2. Visual for holes-seat-thrds		100	Visual — Singly	.0098	0980
			" — Handful	.0032	
			" — Add for long	.0060	
			" — Finish	.0084	
			Pick — Singly	.0133	
			" — Handful	.0084	
3. Gage-Gen. Seat + U.S. Clearance	#89 - 11/421	10	Gage-Plug-Dial-Snap	.0103	0206
			" - Thrd - Loose	.0128	
			" " - Tight	.0325	
4. Ream - Air intake hole		100	Ream — Motor	.0128	1280
			Ream — Hand	.0152	
			Burr — "	.0105	
5. Blow out chips		100	Blow out	.0030	0300
6. Count when gaging			Count - Card - Stock	.0021	0021
7. Use Prod. Tools + Print			Tools & Prints	.0011	0011
			Total Hours		458

ment by dividing the total into 60 minutes and the result into 100. These standard elements and unit hours per 100 are shown on the instruction card (Figure 3) and are ready for use.

The chief inspector writes out his instructions on this card, which is in duplicate, for the detailed inspection of the part, specifying gages and tools to be used, and by means of the standard elements extending the standard units in the adjacent column. By simple addition, he is able to set the base rate in total hours per 100. Thus, the method helps us to get fair base rates on piece parts that are new and different from those in steady production.

It is not to be presumed that this method of using standard time elements will do away entirely with time studies. We still take studies on 10 per cent of our parts and make it a point to cover all important items. We inspect some 1,200 different piece parts, and take studies on about 120, which is quite a saving. We find a definite gain in the skill of our inspectors as well as in reduced costs, and have insured that the continual improvement reflected by increasing bonus earnings will be translated into lower costs by having the time-study department keep standards up to date by taking one new study for every ten standards formulated.

A bonus earning sheet (Figure 4) is used to pick up the various jobs inspected and tie them into the payroll record. This eliminates the necessity for the usual time card and clock-punching, allows the foreman greater flexibility, enables him to utilize personnel to best advantage.

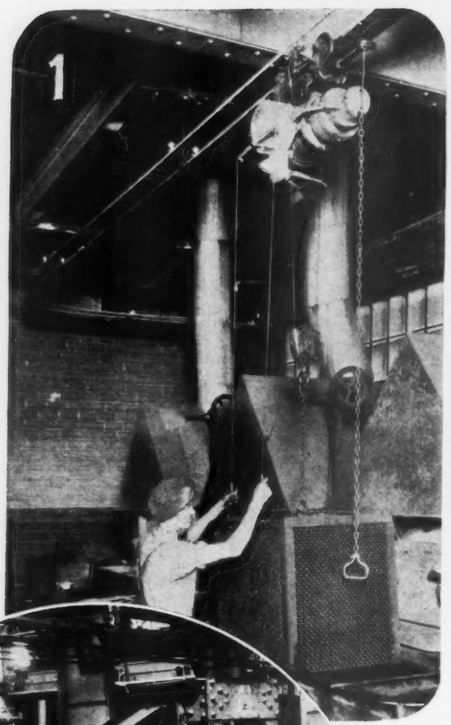
(Since this installation was made, the same method has been successfully applied to stockrooms, shipping, receiving, and testing departments.—ED.)

Figure 4

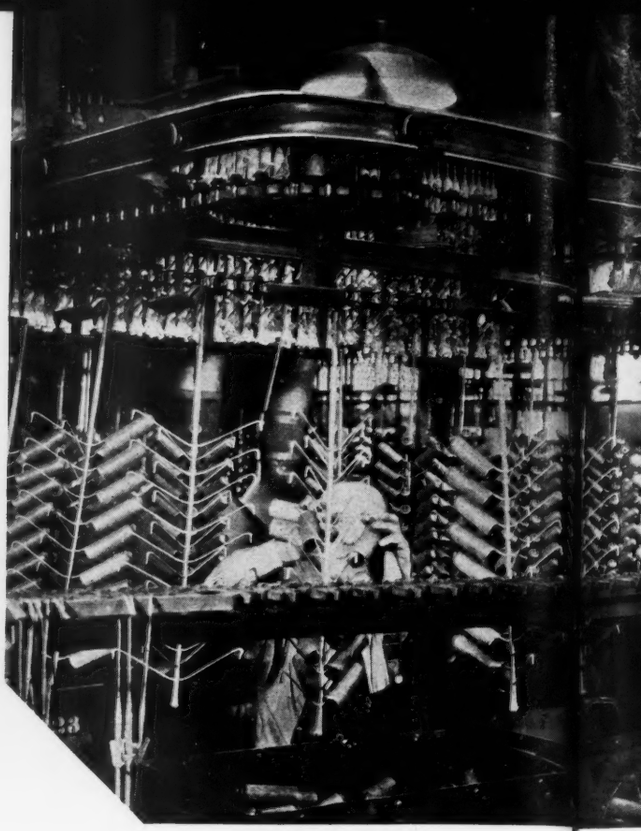
INSPECTION G BONUS EARNINGS

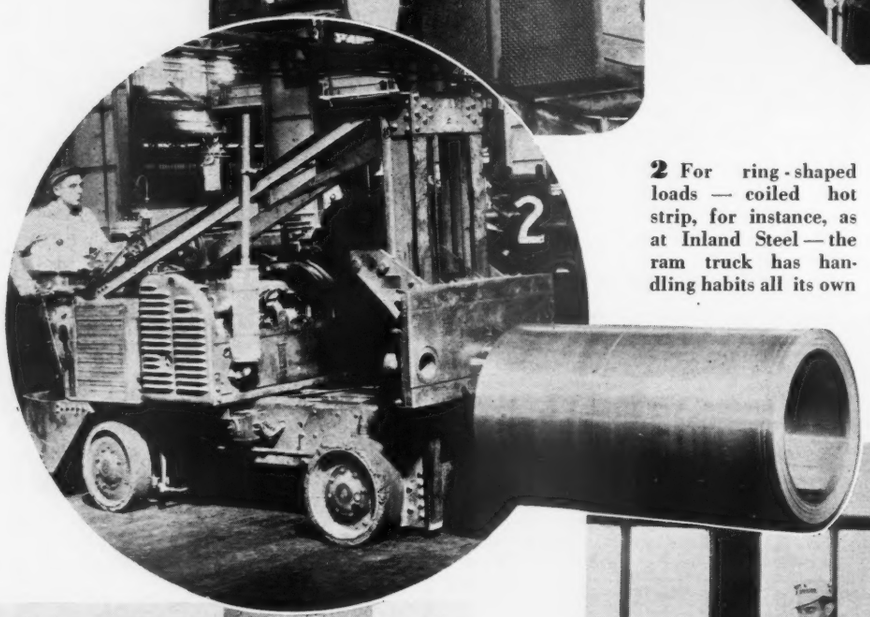
DATE August 14th 1935

PART NO.	NAME	INSP. NO.	ORDER NO.	BOOK NO.	QUAN. INSP.	GOOD	DEFECT.	WORKER NO.	SAMPLE INSP.		INSP. POINTS	HRS. PER C	HOURS EARNED	CLOCK NO.	DISTRIBUTION NAME	HRS. ON BONUS	HOURS SAVED
69-07	Insert bushing	527	8934	1	5000	5000	0	1432	—	—	—	.18	9.00				
118 B 104	Air tube	523	8193	2	2000	1947	53	1380	—	—	—	.34	6.80				
132-614	Valve stem	521 522	8077	1	10000	9592	408	1412	10%	—	—	.13	13.00				
228-507	Check body	529 524	8431	1	10000	980	20	1440	—	—	—	1.25	12.50				



1 Many a tough job capitulates to the right handling equipment. This heat-treating installation is at Monmouth Products Company, Cleveland. To and from movements via tramrail; in and out, by electric hoist

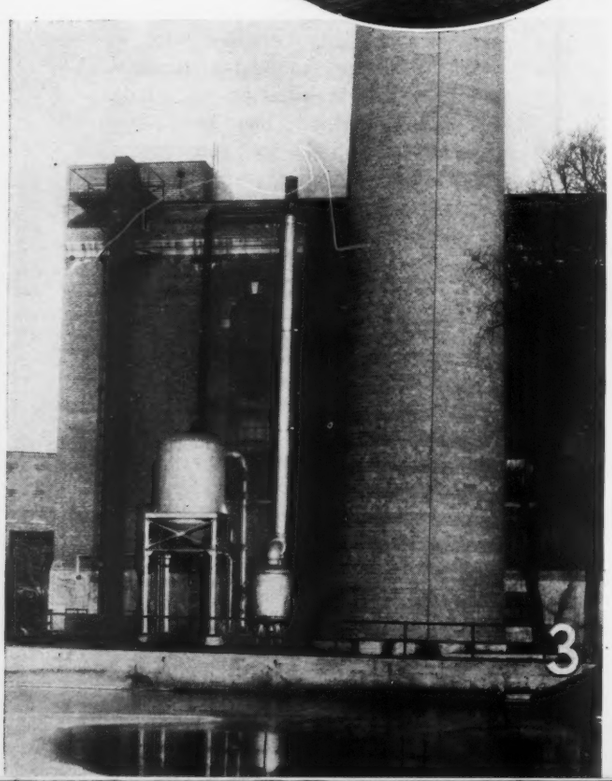




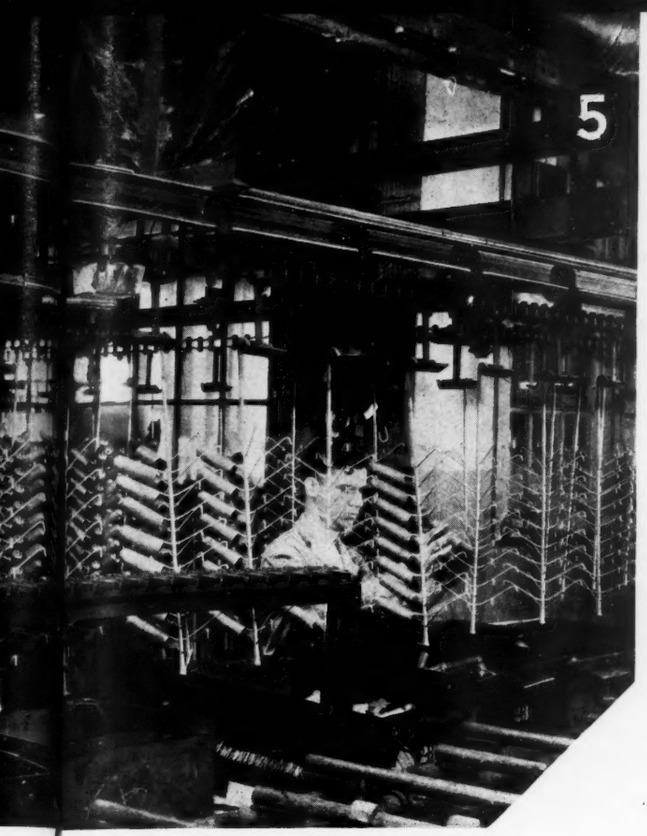
2 For ring-shaped loads — coiled hot strip, for instance, as at Inland Steel — the ram truck has handling habits all its own

CHEAPER TO

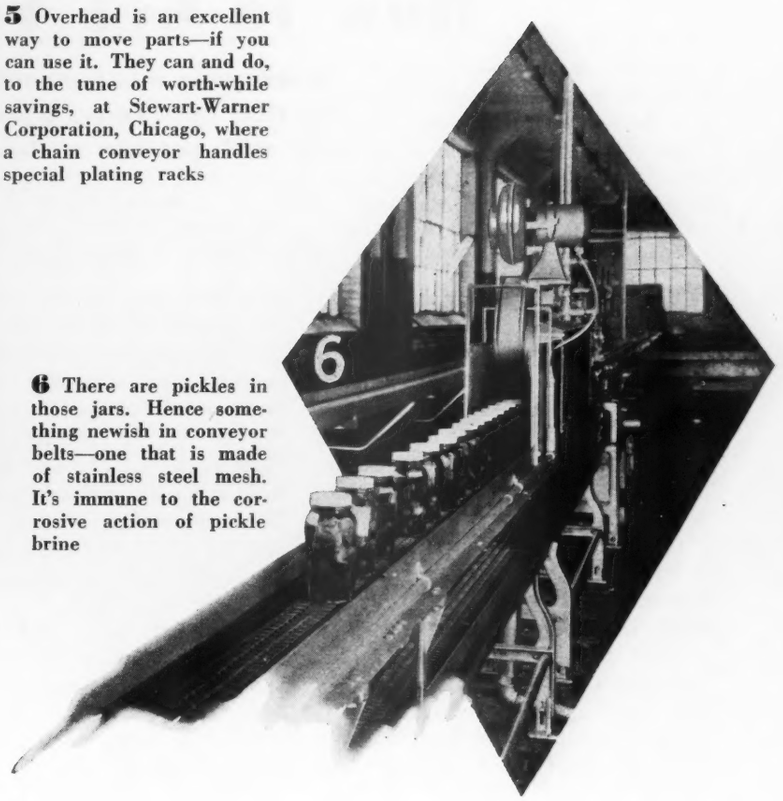
4 Sometimes, in the rush to mechanize, the floor truck is overlooked. Yet what it lacks in spectacularity, it easily makes up in ability to be where needed when needed. Example, spring bearing trucks at Pittsburgh Plate Glass Company, Milwaukee



3 In the industrial power plant. Bucket elevator at M. J. Whittall Associates, Worcester, moves coal from track hopper to belt conveyor with traveling tripper that distributes to bunkers



5 Overhead is an excellent way to move parts—if you can use it. They can and do, to the tune of worth-while savings, at Stewart-Warner Corporation, Chicago, where a chain conveyor handles special plating racks

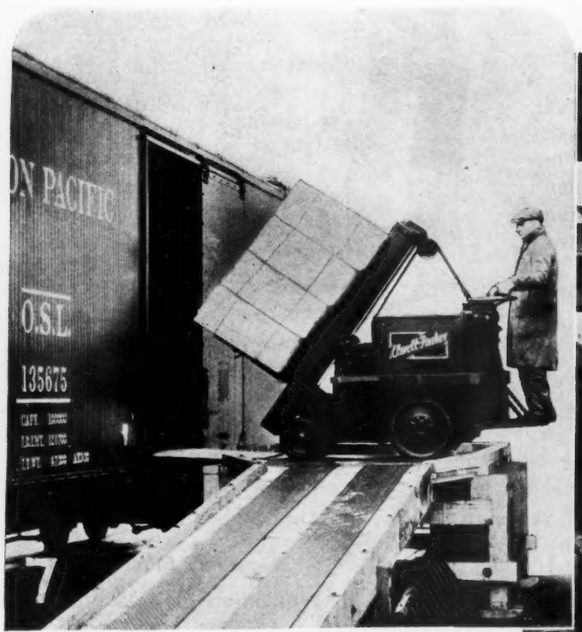


6 There are pickles in those jars. Hence something newish in conveyor belts—one that is made of stainless steel mesh. It's immune to the corrosive action of pickle brine

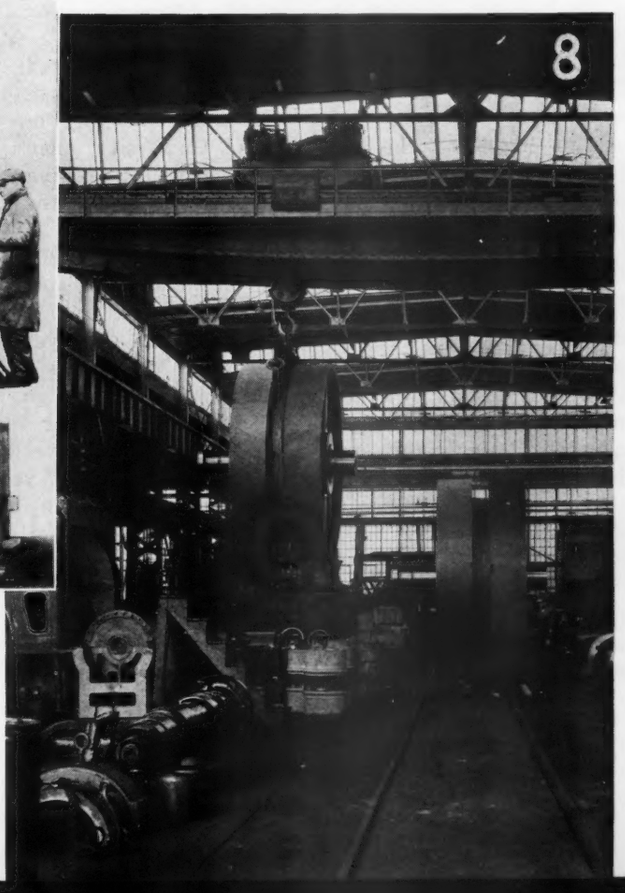
ERTO MOVE IT . . .

. . . with modern handling methods. Whatever the job, there's equipment that will do it better at less cost

8 And for things large and heavy, call the crane. If they couldn't, where would they be at Falk Corporation, Milwaukee, on those not infrequent occasions when huge gears like these have to be bandied about?



7 Crowded dock. Narrow, steep ramp. But the electric truck goes up "in high," turns around on a dime, loads bundles of paper in a boxcar as one of its everyday moving jobs



How to Get Your Man

Word your ads for technical men so that only those who can qualify will gamble a 3-cent stamp

R. A. PERRETT
Mechanical Engineer, Dallas Division
Revere Copper & Brass Corporation, Chicago

THE TIME is coming soon when firms will need additional help in order to keep up with the increase in business. The problem of securing this help seems at first to be a simple one. Thousands are out of jobs and are apparently eager to work. Securing their services should therefore be a simple matter. But is it? Yes, if it is gone about properly. If not, it will be an undertaking that will consume a lot of time and probably result in employing a lot of misfits.

Chief reason for this lies in the fact that an advertisement placed in the newspapers or magazines is liable to result in a deluge of answers from everybody and anybody who thinks he has even the slightest chance of getting the job. Reading all these letters takes time, most of it wasted, because most of the applicants are not fitted for the job.

If Numbers Counted

Such a condition is usually the fault of the advertisement; it has been poorly worded and not carefully planned. For example, take the following familiar ad:

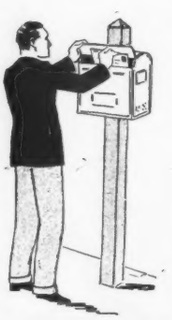
Wanted: Engineer; state age, experience, salary wanted. Box XYZ, Gazette.

Hundreds of engineers who have been out of work would seize the opportunity of answering this want ad. The result would be gratifying if number of answers counted, but it doesn't. First of all, what kind of engineer does Box XYZ want? There are all kinds of engineers. Each may be a specialist in some particular branch of his own field. Thus a mechanical engineer may be an experienced designer of small automatic machines, but be hopelessly out of place attempting to design rolling mill machinery.

If only ten engineers of only ten of the different branches of engineering answered this ad, the result would be a hundred letters, all of which would have to be read and handled before the ten engineers in the branch wanted could be found. This means that nine-tenths of the reading time is wasted because 90 per cent of the applicants are unfit for the job. In fact, they would not have answered if they had known what kind of engineer was wanted. The employer has wasted their time and his own because he did not use one more word to tell the kind of engineer he wanted.

An advertisement like this one is of course ridiculous, but it illustrates the point and appears in the papers every so often. Other ads are more wordy, yet often lack the qualities that get results with the least time and effort. They are too broad in their requirements and waste words asking for information that is not needed until an interview has been arranged. The following brings out these points:

Wanted: Mechanical engineer, experienced in designing special machinery. State age, education, references and salary expected. Box ABC, Gazette.



Any old kind of want ad will bring answers from hundreds of engineers

Suppose you answered this ad and said you were a graduate of Podunk University, had been designing rolling mill machinery for the past 10 years, were 35 years old, wanted $200 a month, and then listed your references.

Suppose the employer who wrote this wants a man who can design special machinery for the printing press trade. He believes that a man should have at least 15 years' experience, but can pay him only $175 a month. You would not get the job. Yet as far as the advertisement was concerned, you were fully qualified. The employer would have to read your letter and many others that were similarly unsuitable in order to find out that your services were useless to him.

Your answers to the questions that he asked regarding age, education, experience, and salary, were not the answers he wanted. He wasted time reading them. When he inserted the ad in the paper he knew pretty well the answers he wanted to receive. Why, then, did he not make his ad up in the form of a statement concerning the type of man he would hire? If he had done this, you would not have answered, because you would have known you were not the man he wanted.

Make the Ad Tell the Story

If this advertisement were rewritten so that it asked no questions, but just stated the requisities of the man for the position, it would read as follows:

Wanted: Graduate mechanical engineer with 15 years' experience designing special printing press machinery. No others need apply. Box ABC, Gazette.

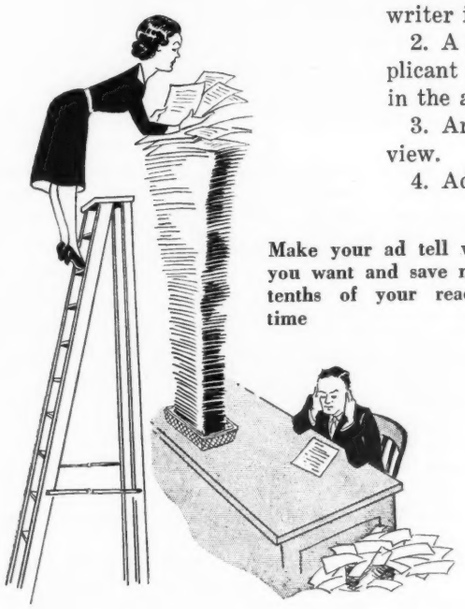
Now it contains no more words, yet it tells the story. There is no need to ask the applicant's age. He must be 35 in order to be a college graduate and have 15 years' experience.

There is no need to ask the applicant to say anything about his experience. The ad states what he must have. Either he has it or he hasn't it. If he answers, the employer can assume that he has it.

Regarding References

The question of salary has been omitted, because it will be discussed at the interview, which is the proper time for it. References are not even asked for. There is time for that at

the interview. Anyway, a man with 15 years' experience is sure to have good references. If he does have a bad reference, he will omit it from the letter of application and from the entire employment procedure if possible.



Make your ad tell what you want and save nine-tenths of your reading time

Almost any ad can be written in a specific manner. The employer knows just about what he wants. All he has to do is state his wants in such a way that no one will answer unless he has the qualifications asked for. By doing so, only those who can fill the bill will answer.

The more qualifications the employer lays down, the fewer will be the replies. Those who do reply will be qualified for the job, and all the employer will have to do will be to interview a few and pick out the man he likes best. He will spend less time reading letters, more time picking out a better man. An ad that is not specific as to the requirements and qualifications of the man necessary to fill the job is a wide-open invitation for anyone to gamble a three-cent stamp on the chance of getting a job he may not be able to hold.

The Ideal Ad

An ideal want ad should consist of three parts only:

1. A statement that a job is open.
2. Some of the specifications and requirements of the man who can fill the job.
3. The address of the employer doing the hiring.

All other details should be left for the personal interview.

Likewise, the first letter of application should contain four parts, and no more:

1. A statement telling what job the writer is after.
2. A simple statement that the applicant has the qualifications stated in the ad.
3. An attempt to arrange an interview.
4. Address of applicant.

This ideal depends upon the honesty of the applicant who answers it. He will be found out at an interview if he has not the qualifications asked for. He will waste time, of course, but the number of dishonest applicants will be few and far less trouble to deal with than a stack of applications from men who are not fitted for the job.

Probably some employers will question the advisability of advertising for help in this manner. They feel that more information is needed in the first letter from the applicant. References should be exchanged, salary discussed, details of past experience outlined. Such information may sometimes be needed. Usually it can be left until the interview.

Why Check Up on All Five?

If references are to be checked up before an interview is granted, of course it is necessary to ask for them in the first letter of application. However, if five applicants are to be picked for an interview and only one is to be hired, why check into the references of all five? Why not wait until the one is chosen, and then check into his references only? It seems like a needless waste of time and trouble to check them all. Granting that the logical procedure would be to check the references of only one man, and he is to be chosen after interviewing five, why require all the applicants who write in to send their references? They are of no use to the employer until the interview is over. He has to read them and gains nothing. He merely wastes his time doing it.

Much could also be said as to why an applicant should be reluctant to give his references in the first letter to an unknown employer for a job he knows nothing about and may not want when he knows more about it.

Many employers firmly believe that the salary question should be broached in the first letter of application, and therefore ask the applicant to state the starting salary he wants.

This question is most unfair. It is not only unfair to the applicant, but to the employer as well. The latter can draw no logical conclusions concerning the value of the services an applicant will be able to render the firm by the size of the salary he asks for. The circumstances of two applicants may be such that one can afford to work for less money, yet they may both be able to render the same value in services. The salary offer should always come from the employer who bases his figure upon two considerations. The first is the top salary that the job would pay to a man who is 100 per cent satisfactory. The second consideration is based upon the employer's judgment of the man in question, his experience, education, and probable length of time necessary to break him in. This can only be done after an interview. Why, then, waste space in the ad asking the applicant to state the salary he wants?

Some ads even go so far as to ask the applicant to state his present salary. This is a preposterous question for anybody to ask. It is no one's business what salary any man is earning, except the man who earns it, the employer who pays it, the income tax collecter, and possibly the man's wife. The question is in very bad taste, and should be left out of the entire procedure of employment.

"No Others Need Apply"

Ads that ask these and other unnecessary questions usually result in a lot of wasted time for the employer. He seldom gets the exact answers he wants, yet he has to read all of them and pick a man he feels a bit uncertain about. How much better off he would be if he simply stated in the advertisement what he wanted and then said: "No others need apply."

Who Gets the Breaks?

A supervisor asks embarrassing questions concerning training, promotion, and pay. They indicate what's on the worker's mind

H. P. DUTTON
Associate Editor

I GET around. I talk to presidents—I talk to foremen—I talk to workers. I also listen. Quite recently a supervisor, whose advice is often sought by his subordinates, posed these questions that had been asked by workers. I present them—along with some of his comments—in just about his own words:

Training

Why train and educate newer employees to fill future managerial positions without giving equal opportunity to present personnel?

Time and time again, a man has been brought into an organization and thoroughly trained for a certain position to the apparent exclusion of present employees equally capable and probably better qualified by experience and loyalty.

Why hire youngsters from schools for plant training without first setting up a definite training program.

In plants following such a hit-or-miss program, the student is apt to remain on one job, if he does it well, until he creates enough disturbance to bring himself to the attention of someone in authority who will either move him on or out.

Why concentrate on building for the future while neglecting the present?

Even a new employee is not entirely dumb. When he sees that eventually he, too, will become an older employee, and that he, in turn, must stagnate in favor of the newer man, why should he remain longer than necessary to get a good schooling? Others will pay well for his training and experience.

Promotion

Why promote newer employees to desirable positions while neglecting equally capable men of longer service record?

Does such action instill loyalty, promote efficiency and a real desire to serve?

Why promote newer employees rapidly because of favorable outside connections over those of longer service and equally—probably more—capable, but lacking the outside contact?

Will such a man be respected because of his personal ability or toadied to on account of his "pull?" In either case, how about loyalty, efficiency, and service both from him and those under his control?

Remuneration

Why pay hourly rated employees or piece workers such rates that their weekly income equals or exceeds that of their immediate foremen?

Why raise hourly or base rates to avoid prospective labor trouble while maintaining supervisory wages or salaries at the old level because these representatives of management are not organized?

Will such actions raise the standard of inspection, improve the quality of supervision, develop clear thinking,

(Continued on advertising page 47)

. . . enough run-of-mine material must be passed through the screen to insure an adequate supply of potential executives

We're Not Paternalistic, But—

Don't tell us it doesn't pay to make the plant a place men like to work in. Our men punch no clocks, enjoy the view, do better work for it

S. L. GABEL
Manager, Superior Tube Company
Collegeville, Pa.

THIS is a new concern. The business was organized a year ago this month. The factory went into production only last January, is still in a manner of speaking a trifle damp behind the ears. Yet today it is shipping thousands of feet of seamless tubing to radio tube manufacturers, is also making considerable amounts of fine tubing—stainless, for instance, for use in hypodermic needles.

Capital requirements, potential markets, manufacturing costs — all these came in for their fair share of examination when we laid our first plans. Plant and equipment, we knew, were major considerations. It was a foregone conclusion that a product like ours could not be made on anything but precision machines, or by any process that could not be closely controlled. Our plant, therefore, is as modern as 1935 construction methods could make it. Our equipment is the newest and best. Draw benches are hydraulically controlled. Annealing is continuous. Temperature control is of the exact nature needed to produce tubing that is uniform and accurate.

Fine Workmen, Fine Tubing

Our preliminary thinking, however, went somewhat beyond these usual considerations, which must of course receive major attention in any business project. Not at all unnaturally, because events of the past few years have driven home the increasing importance of human relations in industry, that preliminary thinking extended to the men we were going to hire. It seemed to us that, once our plant was built and proper machinery installed, the best hope of success lay in the type of man we would have working for us and in his attitude toward his work and his employers.

Fine tubing, in the fewest possible words, demanded fine workmen.

Picked a Small Town

Our ideas boiled down to two fundamental objectives on which the entire relationship between men and management in our plant has since been based:

1. We must have workmen of the highest type. Our manufacturing processes demanded them. Only men of high intelligence could grasp our basic manufacturing philosophy, would respond to the appeals we knew we should want to make.

2. Every man must be happy in his work. Only from satisfied men could we expect to receive the loyalty and interest that would give us the high standard of performance on which we hoped to build our success.

Plant location had much to do with the attainment of these major objectives. We purposely chose a small town and kept away from the large industrial areas. Probably we were lucky to find what we considered an ideal location some 20 miles out of Philadelphia, high on a hill overlooking the Perkiomen Valley.

Maybe this is beside the point, and maybe it isn't, but when one of our men looks up from his work, he is not confronted with gray walls or a waste of smoking chimneys. Instead he looks out across a broad meadow to the woods beyond.

Far-fetched, you say, to provide a view for your workmen? Perhaps. But remember that along with the view go the advantages of a healthy outdoor life after hours. Remember, too, that rent, food, amusements are all cheaper in a small town, and then you realize that the view is only one of the many advantages we derive from our location in this quiet college town. It's a good place for our men to rear their families—and a good place for the Superior Tube Company.

Every Man Was Interviewed

To get men of the type we wanted in this little town of Collegeville, we started right in at the beginning to create the feeling among the men that they were helping us make fine tubing. Every man we employed was personally interviewed by the manager of the company. If employed, we tried to explain to him our aims and our purposes, and to

make him feel that he was really becoming an integral part of the organization.

That policy we have continued. It is followed up today by placing the new man under the supervision of one of the older and more experienced men in the shop, and putting it right up to the latter to teach the newcomer everything he knows about his particular job.

This seems to have the double benefit of removing the "lost" feeling that a new man has on first joining an organization and of creating in the older man a feeling of responsibility in the development of his protégé. He is naturally anxious to have the new man do him credit.

Here, by the way, is an interesting thing. They say good teachers are born, not made. That may be true, but it has been our observation that the instinct to teach and aid is a deep-seated one in the more intelligent type of man. It appeals to his pride to watch the progress of the youngster under him. Also, the act of teaching serves to clarify the older employee's knowledge, even to focus it in such a way as to make its application more effective.

A Chance to Climb

Hourly rates are approximately what the men would get for the same work in competitive plants or for comparable work in other industries. Rates advance as the men acquire greater skill or secure more responsible positions. It has definitely been our policy to push the older men in point of service up to the more responsible jobs. Every man knows there is a chance for him to climb a rung or two up the ladder as the business grows.

There is no time clock in our plant. There are no starting and stopping whistles. There are no shop rules. The door to the manager's office is wide open to any man who has a suggestion or a complaint. Suggestions to date have outnumbered complaints about 10 to 1. A glance at the photograph of "our gang" should supply evidence that we have built up a group of young men filled with interest, enthusiasm, ambition, and satisfaction with their present work.

Average age is just under 30, and three important positions are filled by men not quite 23. The force consists now of about 150 men, of whom 20 are college men and more than 75 are high school graduates. That makes a total of more than half our man power with high school training or better.

Right now we have a long waiting list of men who would like to work for us. No doubt there would be a waiting list in any case on account of the widespread unemployment; the unusual length of the list, on the other hand, is doubtless due to the fact that the men tell their friends and relations about our shop. They probably mention the fact that smoking is allowed. We cannot see why not. Also they are apt to stress the free and easy atmosphere that prevails. There are no women in the plant, so costumes can be as sketchy as the men care to make them. Most of the men arrive in cars that carry six or seven. Operating expenses are "divvied up."

Specific examples of how our somewhat unorthodox policies are working out may be found in two things that happened last winter.

In one case a shipment of tubing was finished and had to be rushed to the Newark airport right in the midst of one of the worst blizzards we have experienced in this part of the country for several years. Roads were icy. It was still snowing hard. Yet when we asked for volunteers to carry the shipment by car to Newark, every man who had a car at the plant offered to do the job. When the weather cleared early the following day, the tubing was well on its way to the customer.

Three O'Clock in the Morning

The other story is of the machine that was erected and put into operation after nearly 20 hours of continuous work. It was 3 o'clock in the morning when the job was finally completed. You see, a large part of our equipment has been designed and built right in the plant. There was no demand that this particular machine go into operation at any such unearthly hour. The men on the job were simply interested enough to work straight through.

All the men, by the way, seem to be self-appointed salesmen for the Superior Tube Company. Not only do they talk about the company and the product during their outside hours, but they are also ready any time to show visitors the details of their work and to expound the merits of the product. This readiness may be ascribed in large measure to the fact that every man in the plant knows a good deal about the entire business. When orders come in or something of interest happens, everyone is told so that he will know just what progress is being made.

At One-Sixth the 1929 Cost

In the last analysis our product is of course our best salesman, so we must look for the final result of our policies in our production and sales record. The company started on a production basis last January with one shift. Since then we have very nearly quadrupled the capacity for which the plant was originally designed. This has been done mainly by working three shifts, in part by the installation of additional production equipment. So far as production costs go, we are now making a higher quality of tubing and meeting more rigid specifications than were demanded in 1929, and yet we are making this tubing at a cost that is approximately one-sixth of what it was six years ago.

It will naturally continue to be our policy to maintain a plant small enough to enable us to retain the close personnel relationships that have to date been such a large contributing factor to whatever success we may have had, and which have also been, we are confident, a source of satisfaction and pleasure to everyone connected with our enterprise.

Why the Industrial Distributor

Summary of his relations with the users of industrial supplies and equipment; analysis of his part in keeping production costs low

JOHN H. FREDERICK
Assistant Professor of Marketing
University of Pennsylvania

THE INDUSTRIAL distributor, often referred to as an "industrial supply distributor," "mill supply house," "supply and machinery distributor," or "wholesaler," is a merchant who purchases certain types of industrial products from manufacturers for resale to industries in his locality. He provides the capital to finance the distribution, in whole or in part, of many industrial products. He maintains a place of business, including a warehouse for the storage of surplus stock; he maintains a force of salesmen, who call upon his prospects and customers regularly; he extends credit and makes deliveries. In other words he assembles certain lines of industrial products in large lots and distributes them in smaller quantities, assuming the risks incident to such business activities.

Occupies Unique Position

The fact that the distributor performs many of the functions of a wholesaler, does not warrant his classification as such, since the greater part—or in the case of the exclusive industrial distributor, the total—of his business consists in selling industrial products direct to consumers in the service and manufacturing industries for use in the operation of their establishments, or as a part of their finished products, and *not for resale.* In this respect the industrial distributor occupies a unique position in marketing. Broadly speaking, he performs two primary functions: (1) He acts as an auxiliary to the purchasing departments of industrial users, as he assumes many of their responsibilities of detailed buying; and (2) he functions as the sales organization for manufacturers.

Industrial distributors show considerable variation in the type and character of products sold. No two sections of the country have exactly the same requirements. One finds distributors in certain sections of New England and the South catering to the particular needs of the textile mills. In parts of Pennsylvania, West Virginia, Kentucky, and Illinois, distributors are organized to serve the special needs of coal mines. In the Detroit and Pittsburgh regions, distributors stock items needed by the metal-working industries.

In other words, while distributors are equipped to provide customers with the supplies generally used by all manufacturing or service industries, they make a special effort to cater to the needs of the industries predominating in their territories.

Special Stocks

With some products this special effort consists of stocking a greater range of sizes and styles than would be carried in another territory. Very often, however, it consists of handling products that would not be stocked by industrial distributors in another section of the country, because of the absence of demand for them there. Distributors also frequently maintain expert service men, particularly trained to work with industries predominating in their localities.

Judging by the number of distributors handling the major groups of industrial products, these groups may be listed, in the order of their importance, as follows: Small tools and supplies, portable electric tools, shop supplies, contractors' supplies, machine tools, heavy hardware, power transmission equipment, power plant and pumping equipment, plumbing and heating supplies, materials handling equipment, electrical supplies.

Nearly all industrial plants purchase some of their supplies and equipment from distributors. Unfortunately, too few make efficient use of these local sources of supply. This may be due to the fact that many industrial buyers regard distributors as convenient sources from which to obtain small quantities, but not large quantities; as places where emergency orders may be filled, but not regular orders; as sources of supply valuable for isolated plants, but not for plants located in central manufacturing districts; or as suppliers for small plants, not for large ones.

How the Distributor Serves

That these are mistaken ideas is evident when one considers the principal services rendered by these middlemen. They may be summarized as follows:

1. *Distributors give immediate delivery from a local stock.* This service permits the user to purchase in small quantities for immediate consumption. Quick deliveries are essential on small lot purchases of products for which the demand cannot be readily anticipated. By giving these quick deliveries the distrib-

DISTRIBUTORS . . .

1. Give immediate delivery from a local stock

2. Attempt to carry complete stocks

3. Are expert buyers

4. Grant credit to small as well as large buyers

5. Offer immediate catalog and price information

6. Carry repair parts of many kinds in a local stock

utor is in a position to aid in solving a common problem in industrial plants, particularly in connection with maintenance—that of procuring emergency supplies. If local stocks were not maintained by distributors, either the manufacturers of the products or the users or both would have to maintain them.

2. *Distributors attempt to carry complete stocks.* This service enables the user to reduce to a minimum the capital invested and the warehouse space required to carry supply stocks. Many industrial products are produced in such a wide variety of types and sizes that it would be impossible for users to carry stocks in sufficient quantities to provide all the varieties required for maintenance or production. Through the consolidation of these stocks in distributors' warehouses, users are assured of adequate service, and the amount of capital and warehouse space required for supply stocks in individual plants is consequently reduced. Resultant savings tend to reduce cost of maintenance as well as cost of production.

Cost of Carrying Stocks

Most manufacturers know little regarding the cost of carrying stocks of production and maintenance supplies. Many large users have been under the impression that, because of their large requirements, it was cheaper to buy direct from manufacturers and to carry their own stocks. The truth is that the slight concessions offered industrial buyers when they anticipate their needs months in advance are more than offset by the cost of warehousing stocks until needed. More and more industrial users are discovering that the best way to eliminate the "hidden costs" of carrying stocks is to buy from distributors in quantities needed for immediate use, thus allowing the distributors to carry the stocks.

3. *Distributors are expert buyers.* Buying is one of the most important functions of the distributor. His success in business is based primarily on his ability to select the supplies that will adequately fill the needs of the plants in his territory. His expertness results from a thorough familiarity with the needs of his customers and a wide acquaintance with the lines of manufacturers of all types of supplies. His contact with the users of industrial products is much more frequent and intimate than that of the manufacturer of such products who attempts to sell direct. He therefore judges the merits of every item he buys according to the standards of his customers.

His Business to Know the Suppliers

It is also the distributor's business to know the manufacturers of supplies. He can afford to devote more time and study to the selection of various products than can the plant buyer, and, because of his constant investigation of various lines, he has opportunities for comparisons that are not often available to the industrial user who buys direct. Manufacturers are frequently limited in the extent to which they can guarantee satisfaction to industrial users. When the distributor selects a product, however, and offers it to his customers, that product carries his stamp of approval as well as whatever guarantee the manufacturer may offer.

4. *Distributors grant credit to small as well as large buyers.* Nothing is more important to the average industrial buyer than the establishment of satisfactory credit relations with sources of supply. Because of his close personal contact with the industrial users in his territory, the distributor is in a better position to judge credit risks than is the manufacturer selling direct, who may be located at some distance from the users of his product. The significance of this service becomes apparent when one considers the fact that in 1932 and 1933 more than half of the manufacturing concerns in the United States either had no ratings, or were rated at less than $5,000 by the standard financial rating reports.

5. *Distributors offer immediate catalog and price information.* A typical general industrial distributor's catalog is a complete cross-section of the lines of products of from 200 to 1,000 manufacturers. The number of items on which buying data are presented frequently runs as high as 5,000. Items shown in a distributor's catalog are the result of a double judgment—that of the manufacturer and of the distributor. The distributor carefully weighs the merits of the items included in his catalog; if an item is not suitable for his customers, he leaves it out. At the same time he emphasizes those items that will, in his experience and opinion, give the best service.

Helps Users Buy Right

The maintaining of complete catalog and price files in many small plants is not practical, although it is frequently a necessary function of the purchasing departments in large plants. Many equipment and supply items are bought only at infrequent intervals, and since the obtaining of quotations before ordering is a standard practice in industrial buying, the distributor is in a position to assist industrial users in buying efficiently.

6. *Distributors carry repair parts of many kinds in a local stock.* Such things as valve disks, chain hoist parts, standard gear replacements, and numerous other items are regularly furnished out of stock. One distributor analyzed his stocks and orders and discovered that his average stock of parts included some 1,207 items, and that he received an average of 35 orders for parts every week, most of which were marked "Rush." The time elapsing between receipt of an order and its delivery by a distributor is much less than the time required to secure some part direct from a manufacturer.

Here Sales Has the Say-So

And why not? queries this production executive. Who am I to tell the sales department what it can or cannot sell?

GEORGE M. FOSTER
Vice-President, John Morrell & Company
Ottumwa, Iowa

WHEN the chief production executive of a meat-packing firm hears someone debating how much control the sales department should exercise over production, or more especially hears a production executive in some other line objecting to the efforts of his sales department to have too much say over the factory, he smiles inwardly—or else laughs out loud. For, with any well-run packing plant, control of production schedules by the sales department is neither a problem nor a theory. It is an actuality which the production department recognizes as necessary and welcomes.

Control by Sales Essential

Mind you, I have no opinions as to whether such control is necessary or desirable in other industries. In our business it is essential. And this little statement of how and why we do it—which is probably more or less how it is done throughout the packing industry—is given simply in the hope that it may help to clarify the thoughts of executives in other lines. If it does no more than convince some recalcitrant production executives who have been bucking sales control of their plant schedules, it will have accomplished something well worth while. And remember that I am a production executive, not a sales manager!

In our business the margin of attainable profit is extremely narrow. Moreover, much of our product is perishable and has to be sold at whatever price will move it — no matter whether or not this price causes us a loss. Our line of products is widely varied. It is possible to cut up a hog in any one of a thousand ways. The one best way to use any animal at a given time is the way that will produce the best price. And unless we process the meat in such optimum style, we stand a good chance to lose the little sum per pound that is the difference between profit and loss.

Here is an instance. This morning in the pork-cutting room I noticed the men on the line that dresses shoulders were not trimming all of them into "picnics," those little pieces that are later smoked into something resembling small hams. Instead they were cutting the meat off the bone of the heavier shoulders, separating the lean from the fat, and loading these lean scraps into trucks.

The cause was apparent to anyone who knows our line of business. The sales department had decided that with the supply of picnics available, the market would be a little soft. At the same time, they foresaw a stiffening of sausage prices a few days ahead, so had issued instructions to convert all shoulders weighing over 7 pounds into sausage scraps. Nobody in my own production organization had bothered to notify me—which is as it should be. If the sales department wants sausage, sausage it gets. That way lies a net profit.

It is always a little appalling to me to see the assurance with which some production men believe they know exactly what should be turned out by the factory, and in what proportions. After all, the sales department must convert those products into accounts receivable and thus into net profits. It is in constant contact with he market. Our sales manager talks with New York and Chicago several times a day, and gets constant reports from the field organization. If he decides halfway through the morning that he wants more hams canned and cooked, and fewer sold as they come from the smokehouse, who am I to object because it may be a little inconvenient for us to shift over? After all, what we all want is a profit.

Why Shouldn't Sales Know?

Certainly it seems reasonable to me, as a production man, that the sales department should know better than I what should be manufactured. And I suspect that in many organizations where difficulties arise from this sort of set-up, the difficulties are properly attributable at least as much to the men who head up the plant as to those who head up sales and distribution.

Only yesterday the pork-cutting line may have been trimming all shoulders into picnic hams. Today sales foresees a softening of the market for picnics and a stiffening of sausage prices, so out goes the order to convert all shoulders weighing over 7 pounds into sausage scraps. If the sales department wants sausage, sausage it gets

Quality Spielers

New variety of contest makes quality enthusiasts of workers in three Cellophane plants

EMMITT HASSETT
Personnel Supervisor
Du Pont Cellophane Company, Old Hickory, Tenn.

Mrs. Massey (née Sadie Wilkerson) took first prize in Quality Spieler Contest at the Old Hickory plant, won a trip to Niagara Falls. Harold (Red) Preston and Linwood (Slim) Brinson (right), winners at Spruance and Buffalo

"QUALITY is an intangible something instilled in a product by the perfect coordination of the brain, eye, and hand, mingled with a perfect application of standards." With this definition the winning speech in the Quality Spieler Contest conducted at the Du Pont Cellophane Company's Old Hickory (Tenn.) plant was concluded and the winner had a trip to Niagara Falls to look forward to.

Girl Spieled Best

A girl from the Finishing Area bested four male aspirants in the finals held at a dinner meeting in one of Nashville's hotels, but two men were declared winners in similar contests held at the Spruance and Buffalo plants. After the winners had made their prize trips, exchanging visits at each other's plants to deliver their talks, "finis" was written to this contest. All employees had been invited to compete to the end that a better understanding might be created of the need to produce a product of high quality and uniformity, to maintain high quality standards that result in customer satisfaction, repeat orders, and job security.

Rules for the speeches limited them to 15 minutes and allowed all hourly rate employees to participate. The plant was divided into five groups within which first shift and then inter-shift eliminations were held. Winners of the inter-shift eliminations represented their groups in the final contest.

Judges of shift eliminations were shift members who attended. Inter-shift winners were selected by judges appointed by area supervisors, and judges of the finals were selected by the plant superintendent.

Decisions were based on delivery and material. Each judge was instructed to make an independent numerical rating of each of the contestants, giving five points for the best, four for second best, three for third, and so on.

Shortly after the winner had been selected, the winners from Richmond and Buffalo were entertained, and all three winners delivered their speeches in five meetings which enabled all employees to attend. Similar meetings were held at the other two plants when the Old Hickory winner visited there.

Over a Hundred Entries

Of almost 1,000 Old Hickory employees, approximately 11 per cent participated in the contest. Questions were asked to suggest the type of material that might be used. How does the quality of our product affect my job? What effect may poor work on my part have on my fellow-worker? How am I responsible for protecting the name of the company? Why should we produce a high-quality product? What is the effect of uniformity on our product?

Ammunition for the Winner

To maintain lively interest in the contest, the plant paper carried weekly references to it and ran brief, pertinent contributions by individuals within the plant. One area supervisor wrote an article appealing to company loyalty in the interests of quality. The production superintendent pointed out the need for keeping a clean shop if the product was to meet its requisite of cleanliness. And the chief chemist gave the winner some of her ammunition by driving home the fact that each individual was indirectly selling quality. Each was demanding quality when he had occasion to buy his own product in his every-day purchases; let each see that he was producing quality.

You Want to Know

. . . and the editors will gladly tell you . . . more about the things mentioned on this page

• BALANCE, low-priced, weighs up to 100 grams, has sensitivity of 1/100 gram. Small, light, can be carried to the job in a pocket. (11501)

• SYNTHETIC rubber coating. Brush it, spray it, spread it, dip the product in it. Made with quick drying, non-flammable solvent. Resists acid and alkaline solutions, also oxidizing agents. (11502)

• HOW owners of acetylene generators may capitalize on carbon residue. Told in a booklet now available. (11503)

• SPINDLE newly developed by Lancashire firm will, they say, save $50 a year in the power consumption of an average ring spinning frame. (11504)

• SCALE, fountain pen size, weighs letters and other mail matter up to half a pound. (11505)

• YOU who've read ". . . And Sudden Death"—and also you who haven't—will want every one of your truck drivers to have "I Drive Safely," a 64-page pocket-size booklet that is being distributed free in the interest of safety on the highways. (11506)

• PLUG IN anywhere you like in the new continuous strip that has outlets every 6 inches. (11507)

• RULES and regulations of National Labor Relations Board can now be had. (11508)

• GAGE, electric, portable, measures thickness of porcelain enamel, paint, or other non-magnetic materials applied to flat sheets or plates of steel or iron. (11509)

• VISIBILITY meter permits seeing specialist to determine proper seeing conditions and appraise relative visibility of objects. Flat and black, it's held up to the eyes like a pair of opera glasses—and is as simple to use. (11510)

• DUPLICATING machine, British, is said to reproduce drawings and typewriten matter without stencils and ink on anything from thick cartridge paper to Cellophane. (11511)

• SURVEY of practices of 53 companies tells how to control costs and operation of business automobiles. (11512)

• SAY your piece in the general direction of the transmitter of a new communicating system that picks up the sound, amplifies and transmits it to any part of the plant. (11513)

• INJECTION molding—a new process for high-speed large production and multiple molding of thin-walled articles—is described in a booklet on molded plastics. (11514)

• INSULATING material, new, may be produced from ordinary portland cement in a regular concrete mixer. Can be cast in slabs or sheets, or poured on the job. (11515)

• BALL BEARINGS, photographic review of major steps in manufacture and testing of. Say the word if you want a copy. (11517)

• TAKE temperatures of motors, generators, etc., with new instrument that's quick and accurate. (11518)

• PAINT sticks perfectly to galvanized iron surfaces that have been treated with a new chemical. (11519)

• WEATHER forecaster, pocket size, follows what appears to be a major trend in instrument manufacture—it is plastic molded. Retails, incidentally, for a couple of dollars. (11520)

• HOW the dollar was undermined, is the subject of a booklet you can have for the asking. It has excellent charts of prices and wages, business activity, industrial production, etc. (11521)

Rubber face piece, featherweight molded plastic inhalation fitting and exhalation valve device, insure comfort and health of the man who has to wear this new gas mask. (11522)

• CHIPPING goggle, just announced, has eye cups shaped to allow natural, full, and wide vision; is equipped with interchangeable lenses of specially toughened glass. (11523)

• MENDING compound has synthetic resinoid base, is easily sawed, carved, nailed. (11524)

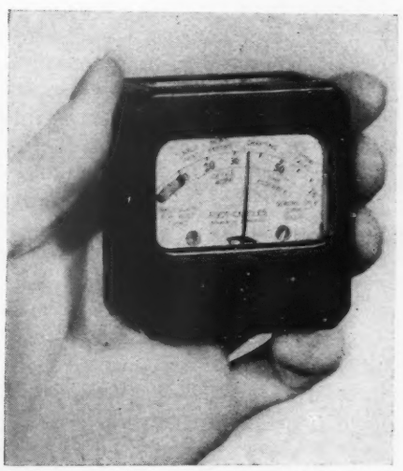
• HUMIDIFIER for factory office, no bigger than small radio set, evaporates up to 12 gal. of water a day, is automatically controlled. (11525)

• AIR GRINDER, just out, is 5 in. long, weighs 8½ oz., develops 100,000 r.p.m. (11526)

• FOR WALTONIANS, there's an electric boat with a 2-m.p.h. trolling and casting speed. Noiseless, of course, so as not to scare the fish. (11527)

• BICYCLE, French invented, British made, is said to be capable of making 30 m.p.h. (11528)

• NEWEST desk accessory has 5-year calendar with 3x5 renewable memo pad, is available for premium use. (11529)



Joe Cook, famous comedian and collector of "things no bigger than the palm of a man's hand," will have to have this new light meter. It's 2¼ in. square, 1⅛ in. thick. On the front, a scale with a range from 0 to 75 foot-candles. On the back, recommended minimum foot-candle values for various types of work. (11516)

• WHEN in New York, don't forget to visit the permanent exhibition of metals and plastics. (11530)

• LACK of skilled tongue setters is delaying deliveries of American orders for Jews'-harps from Birmingham, England. (11531)

• UNCLE SAM, heeding the cry of the philatelist for accurately centered postage stamps, is using photocells to guide perforating machines. (11532)

Paper Cost of Diesel Power

Will be a long way from the truth unless proper allowance is made for all items of fixed, operating, and maintenance expense

WILLIAM W. GAYLORD
Consulting Engineer
New Haven, Conn.

UPON receiving a report on diesel power costs from a plant similar to his own, an executive recently undertook a study of the report and an analysis of his own power problem. The report showed an average monthly power cost of $76 against an average of $225 for power purchased prior to installation of a diesel-driven generator a year earlier.

First step was to check these reported power costs. The generator is of 75-kw. capacity, driven by a 135-hp. engine, and operates an average of 16 hours a day, 5 days a week. The average net generator output was 30 kw., which for 320 hours gave 9,600 kw.-hr. per month. The labor for attendance was about 1 hour per day. On this basis, Table I shows actual out-of-pocket operating expense per month. Table II gives the cost of the same amount of purchased energy.

Getting the True Cost

Although these reported costs gave a comparison of the actual month-to-month expenditure, they were not a true comparison of total costs, since nothing was included for maintenance, insurance, taxes, or capital charges. Allowing for these charges, the total estimated monthly cost of generated power was as shown in Table III.

The reduction in the power cost was, therefore, around 30 per cent instead of the 70 per cent reported. It is very substantial, nevertheless, when it is considered that the average load is only 40 per cent of the capacity of the plant.

After analyzing these reported power costs, this executive made a similar analysis for his own plant. The highest demand ever recorded was 140 kw.; the highest in the past two years was 121 kw.; the average monthly demand is 109 kw. Average consumption is 18,400 kw.-hr. per month. One department operates two 8-hour shifts; the remainder of the plant operates 8 hours per day. The average day load is about 90 kw., and the second shift load about 25 kw.

This analysis showed that a capacity of at least 150 kw. would be required, but that one large unit would not work out so well as two or three smaller ones, even though its first cost were lower.

TABLE I. Diesel Operating Costs, as Reported

Fuel oil, 960 gal. @ $.06	$57.60
Lubricating oil, 12 gal. @ $.55	6.60
Labor, 20 hr. @ $.60	12.00
Total	$76.20

Cost per kilowatt-hour, cents, 0.794

TABLE II. Cost of Same Amount of Purchased Energy

Demand charge, 40 kw	$92.00
Energy charge, 9,600 kw.-hr	163.50
Total	$255.50

Cost per kilowatt-hour, cents, 2.66

TABLE III. True Monthly Cost of Diesel Plant Operation

Fuel oil, 960 gal. @ $.06	$57.60
Lubricating oil, 12 gal. @ $.55	6.60
Labor, 20 hr. @ $.60	12.00
Maintenance, $1.60 per kw. per year	10.00
Taxes and insurance,* 1.5% per year	11.88
Capital charges, 10.2% per year	80.75
Total	$178.83

Cost per kilowatt-hour, cents, 1.86

*Assuming cost of the installation as $9,500 and a life of fifteen years.

TABLE IV. Estimated Monthly Operating Costs of 150-Kw. Diesel Plant

Fuel oil, 1,840 gal. @ $.06	$110.40
Lubricating oil, 25 gal. @ $.55	13.75
Labor, 30 hr. @ $.60	18.00
Maintenance, $1.60 per kw. per year	20.00
Taxes and insurance, 1.5% per year	23.75
Capital charges, 10.2% per year	161.50
Total	$347.40

Cost per kilowatt-hour, cents, 1.89

TABLE V. Cost of Same Amount of Purchased Energy

Demand charge, 109 kw	$200.50
Energy charge, 18,400 kw.-hr.	261.90
Total	$462.40

Cost per kilowatt-hour, cents, 2.51

For simplicity, the first estimate was based on two 75-kw. units with one unit running only on the day shift. Table IV shows that costs of diesel operation would be about 1.89 c. per kilowatt-hour, whereas purchased power (Table V) would cost 2.51 c. per kilowatt-hour. Hence the estimated reduction in power costs would be about 25 per cent.

The two 75-kw. units would have ample capacity, but production would be curtailed if either went out of service during the day shift. Therefore the installation of three 60-kw. units, two of which would in an emergency carry the whole present load, appeared to be more desirable. First cost would be increased by about $3,000, and monthly power cost by about $30, reducing the saving to about 18.3 per cent.

Also taken into consideration was the possibility of rate reductions for purchased power, but even when liberal cuts were assumed, the purchased power cost was found to be higher.

The effect of an increase in load, requiring installation of another 60-kw. unit at the end of five years, was found not to change the general conclusions of the analysis. Cost per kilowatt-hour for generated power remained below that for purchased.

Analysis proved that in this case the installation of a diesel generating plant would be a sound investment, but the actual results would have been most disappointing if the expected returns had been based on the cost of diesel-generated power as reported by the other plant. A comprehensive analysis, in which proper consideration is given to all operating conditions and cost factors, is always necessary in order for actual results to approach expectations.

Specifications for Lubricants

O. L. MAAG
Lubricating Engineer
The Timken Roller Bearing Company
Canton, Ohio

PRIMARY functions of a lubricant are to dissipate heat, keep foreign matter out of bearings, and prevent rust and corrosion. These functions cannot be accomplished unless lubricants of correct consistency are used under proper loading conditions. Bearing size, speed, temperature, load, and general operating conditions must be considered when making a selection.

Grease should be compounded from high-grade soap and refined mineral oil, and be free from corrosive matter or fillers that could act as lapping agents. Its consistency must vary with temperature and operating conditions.

For general machinery applications, lime-base greases are recommended when moisture is present. A bright copper or steel plate should show no marked discoloration after being submerged in the grease for 24 hours, and the grease should show no bleeding or separation either in storage or use. As an additional test, it may be heated to 250 deg. F. and allowed to cool, noting whether it comes back to proper consistency and what quantity of oil separates. A maximum moisture content of 1 per cent may be allowed, and 2 per cent of ash.

Oil from which grease is compounded should have a minimum flash point of 340 deg. F.; minimum fire test of 380 deg. F.; viscosity, Saybolt Universal, of 200 seconds minimum at 100 deg. F.

For heavy-duty applications, the grease must function satisfactorily under all water conditions encountered, and a bright copper or steel plate must show no marked discoloration after submergence in the grease for 50 hours at normal bearing temperature. A maximum moisture content of 1 per cent is allowable.

At speeds above 1,000 r.p.m., oil is considered more satisfactory than grease, although grease can be used on the smaller bearings. For bearings over 6 in. in outside diameter medium to medium soft consistency greases are recommended up to speeds of 500 r.p.m. For speeds above 500 r.p.m., oil is considered the better lubricant.

Much Depends on the Temperature

High-temperature conditions require special consideration. A lime-base grease will usually melt around 150-175 deg. F.; it is therefore useless for high temperatures. Soda-base greases will usually hold up to over 200 deg. F. Above 200 deg., better results are generally obtained with an oil having a viscosity of 100-200 seconds, Saybolt Universal, at 210 deg. F.

Bearings exposed to extreme cold are best lubricated by an oil with low viscosity and low cold test. A highly refined mineral oil with a viscosity of 75-500 seconds, Saybolt Universal, at 100 deg. F. is recommended. Light-bodied oils are used at high speeds and light loads; heavy-bodied oils at low speeds and heavy loads.

Straight mineral oils increase in film strength as their viscosity or body increases, but in extreme-pressure lubricants viscosity does not seem to be so important. Tests on extreme-pressure lubricants indicate that those showing a decrease in load-carrying capacity during a 6-hour test under a load of 20,000 lb. per sq.in. also show a decrease in sulphur or chlorine content, and that lubricants compounded from a well-refined mineral oil and an extreme-pressure base, such as a chlorinated fatty oil, are more stable than those made from dark, unrefined oils.

Increasing the sulphur content in an extreme-pressure lubricant increases the abrasive properties, whereas increasing the chlorine content apparently reduces the abrasion and at the same time increases the load-carrying capacity. Lead, hexachlorethane, chlorinated retene, and certain other definite chemical compounds (including phosphates) have likewise shown possibilities in the extreme-pressure field.

Abstract of a paper delivered at the annual meeting of the Association of Iron and Steel Electrical Engineers.

More Jobs for Electron Tubes

Butcher, baker, and candlestick maker are using them in many ways to give services needed to keep production flowing smoothly

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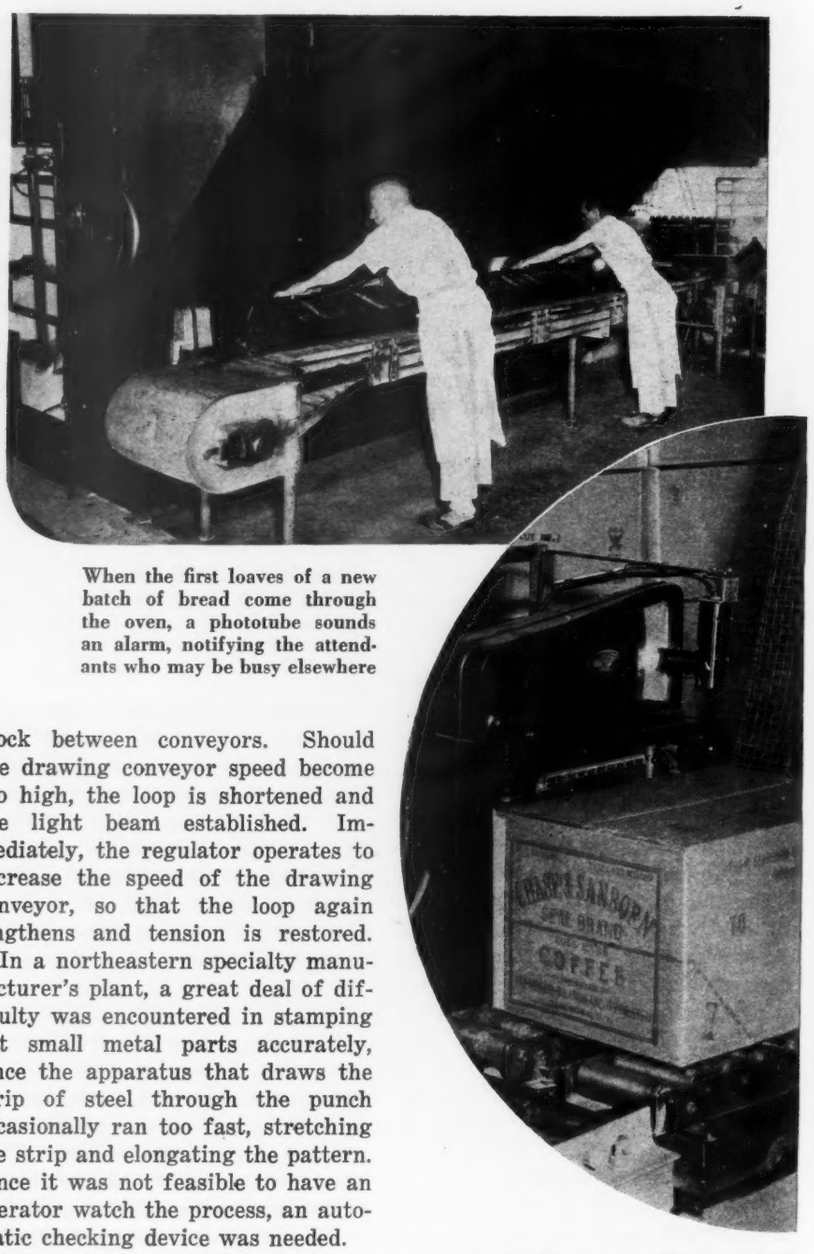
Industrial Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

ELECTRON tube applications are becoming more common and more numerous as time passes and their possibilities are recognized. During the past year, many new and interesting applications have been made.

One photo-electric system was installed in connection with scales to check automatically the count of cans of coffee in sealed containers. If the count is correct, as indicated by the position of the scale beam, the light beam will be intercepted by a sheet-metal vane attached to the scale beam. Should one or more cans be missing, the scale beam will assume a lower position, allowing the vane to move out of the path of the light. The phototube upon which the light falls then trips a grid-glow tube, so that it passes current to operate a contactor, closing an alarm circuit.

In order to prevent operation when the scale platform is empty a switching system is used to make the photo-electric system inoperative until the platform has assumed a certain level indicating that a container is in place. If desired, the operation may be made more completely automatic by having the photo-electric equipment operate a device to remove short-weight containers from the conveyor line. There has not been a single complaint of shortage since the installation was made.



When the first loaves of a new batch of bread come through the oven, a phototube sounds an alarm, notifying the attendants who may be busy elsewhere

Done with a Light Beam

Tension of rubber tire-tread stock, hose, or other materials being transferred from one process conveyor to another may easily be regulated by electronic means. Here again the phototube and light beam are used because of the weakness of the web, or because it would be marred by a mechanical device. The equipment is installed so that the light beam is projected at a point corresponding to the lowest position of the loop of stock between conveyors. Should the drawing conveyor speed become too high, the loop is shortened and the light beam established. Immediately, the regulator operates to increase the speed of the drawing conveyor, so that the loop again lengthens and tension is restored.

In a northeastern specialty manufacturer's plant, a great deal of difficulty was encountered in stamping out small metal parts accurately, since the apparatus that draws the strip of steel through the punch occasionally ran too fast, stretching the strip and elongating the pattern. Since it was not feasible to have an operator watch the process, an automatic checking device was needed.

Gages, which are the negative of the pattern stamped in each part, were made and incorporated in the machine in such manner that the portion of the strip which had just been punched would be exactly over the gage while the succeeding pattern was being punched. A specially designed light source was placed above the gage and a phototube located below it. If the pattern being gaged is elongated, as indicated by the admis-

sion of light in the area between the pattern and its negative gages, the machine is stopped and an alarm sounded. An operator then readjusts the drawing mechanism and starts the process again. Wastage is almost entirely eliminated since the photo-electric gaging device can detect elongation of the metal before it has become so serious as to necessitate scrapping.

Protection of pedestrians crossing a trucking lane and a railroad track running side-by-side in a steel mill in the Pittsburgh district is easily accomplished by photo-electric equipment installed on either side of the pedestrian crossing. Only a single installation is required on either side to cover both track and lane since the light beam can be projected across both. A warning signal is sounded for a definite length of time as soon as a train or truck approaches the crossing and intercepts the light beam. For the operating conditions imposed on it, a simpler and less expensive type of apparatus could not have been found.

Checking up on the packers. If one or more cans of coffee are missing from a carton, the scales show it, the phototube does something about it—by sounding an alarm

Several manufacturers of sandpaper are now using rectifier tubes to obtain an improved product that is between 30 and 40 per cent more efficient, and longer lived. This new process uses a strong electrostatic field supplied by a high-voltage transformer. After the voltage has been stepped up to between 20,000 and 100,000 volts, it is rectified and conducted to two electrodes on the paper coating machine, one located above the other. The paper, glue side down, passes under the upper, positively charged electrode while a belt carries the abrasive grains over the lower, negative electrode.

As the grains enter the highly charged field between the electrodes they become charged, assume the position in which their long axes are perpendicular to the electrodes and paper, and move toward the upper electrode. They are then, of course, intercepted by the glued surface of the paper, still with their long axes perpendicular to it. The working surface of the sandpaper produced in this way consists of an evenly distributed coating of abrasive particles with their sharpest points projecting outward.

Calls for More Beans

A canning factory recently made an installation of photo-electric apparatus to indicate low level in a bean-storage tank. Windows were cut at the proper level and a light beam, intercepted until the tank is almost empty, is projected through the tank. Screen wire of suitable mesh was placed in the windows. When the level of the contents goes below the windows, an alarm is automatically sounded.

In the high-voltage testing laboratory of an electrical manufacturer it was necessary to provide protection to the testers and engineers without interfering with the movement of apparatus on the test floor. Chain fences were tried but were found inconvenient to manipulate.

Photo-electric equipment was the solution. A light source on the wall between the operator's control desk and the test floor inclosure throws a beam upon a mirror mounted on a movable stand which can be placed in any desired location. The light beam is reflected from the mirror upon the phototube, which is connected through flexible conduit so that it can be moved as desired. With this arrangement, apparatus may be moved in and out of the light-fenced inclosure without the trouble of removing and replacing a physical barrier; yet the operator is completely protected if he enters the inclosure while power is on.

Here Come the Loaves

An electric eye, watching the delivery end of a long conveyor oven in a large bakery, informs the operators when a new batch has come through. Passage of a row of loaves from one end of the oven to the other may take 30 min. or more. Each time that baking of a different kind of bread is started there is an interval during which no loaves are delivered, and the men have other tasks to perform. It is imperative, however, that they return to their posts when the baked loaves begin to come through.

A light beam focused across the delivery end of the oven operates a photo-electric relay which actuates an alarm calling the operators.

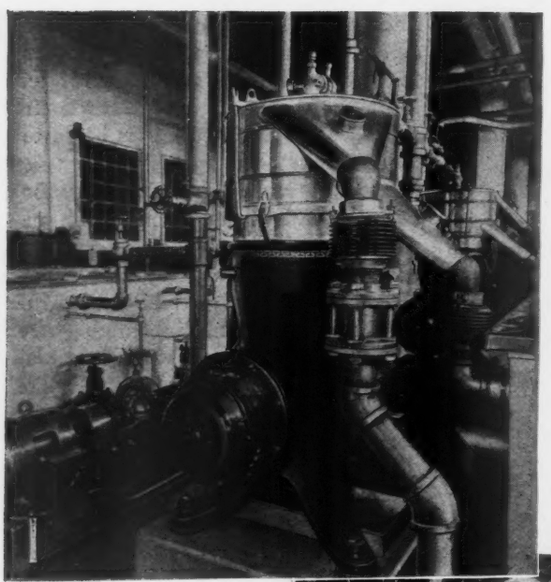
All glass parts on meters, instruments, lenses, and light bulbs are completely covered with a non-flammable, transparent, celluloid-like material. If a bulb or a glass breaks, the pieces of glass are confined by the covering, safeguarding the food products.

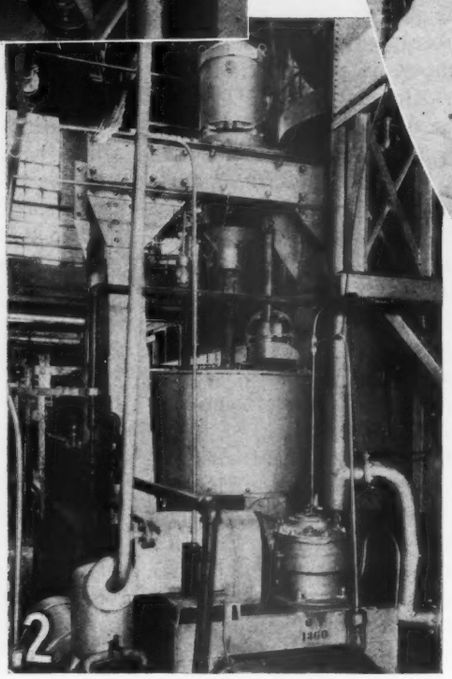
An interesting application of photo tubes on a conveyor to prevent its becoming congested has been installed in an ice cream plant. Two feeder conveyors supply one outgoing line from the cold room, and when both feeders are busy it is possible to concentrate too many containers on the single outgoing line.

Two light sources and phototubes are placed across the output line. If congestion occurs, both beams are intercepted, and the two contactors for the two photo-electric relays outside the cold room combine in operating one alarm. When this occurs, a worker bundles up in coat and boots and goes into the cold room (temperature, —48 deg. F.) to take care of the situation. The electric eye operates as effectively as in a room of normal temperature, allowing the workmen to keep out of the lower-temperature room as much as possible.

CENTRIFUGALS AT WORK

More applications where they have helped solve production problems





1 Purifying oil used for washing bearings and parts in a ball bearing factory

2 Removing excess moisture from crystals in a chemical plant

3 Drying shellac in a refining plant

4 Drying silver crystals in a metal refinery

5 In a vegetable oil refinery

6 Removing oil from chips in a metalworking plant

7 In connection with a special process for treating gasoline

8 Drying sheep hides in a packing plant

5
6
7
8

To Keep Transformers Fit

See that they are given periodic inspection of all parts, including insulation resistance measurements and dielectric tests of the oil

J. S. MURRAY
Chief Electrical Engineer
Follansbee Brothers Company
Follansbee, W. Va.

IMPORTANCE of proper installation and testing of transformers prior to putting in service was considered in a preceding article (October, p. 440). Largely due to the absence of moving parts, transformers require, or can get along with, less maintenance attention than many other kinds of equipment. Nevertheless, certain points must be checked up at regular intervals in order to minimize the possibility of breakdown. Of these items, the condition of the insulation and of the insulating oil are among the most important.

Bushings should be inspected and their insulation resistance and that of the transformer windings tested at least once a year. For this purpose we use a 500-volt ohmmeter and a 1,000-volt bridge Megger. The bridge part is used for certain shop and laboratory work, and we find these instruments suitable for checking insulation resistance in the field.

First of All

Our first step is always to check the insulation resistance of an entire unit, such as a bank of transformers, large motor, generator, or what not, with all appurtenances attached. If the reading is greater than 1 megohm per 1,000 volts on the main object, no tests are made on the component parts. On the other hand, if a low reading is obtained, the various parts are segregated until the portion of the machine or transformer bank in which the low reading is found is definitely isolated. In making such tests on transformers the bushings and certain portions of the buswork, insulators, and so on, are included in the readings. In addition, tests on the insulation between the high- and low-tension windings are also made. Each winding is, of course, tested, with the buswork and insulators.

Typical results obtained in a recent test of the transformer and oil switches in our outdoor substation are:

NORTH BANK TRANSFORMERS

Phase A

High to ground—100 meg.
Low to ground—100 meg.
High to low—100 meg.

Phase B

High to ground—Infinity
Low to ground—Infinity
High to low—100 meg.

Phase C

High to ground—100 meg.
Low to ground—Infinity
High to low—Infinity

NORTH BANK 25-KV. OIL SWITCHES

Phase A

Bushing to ground—Infinity
Bushing to ground—Infinity
Bushing to bushing—Infinity

Phase B

Bushing to ground—100 meg.
Bushing to ground—100 meg.
Bushing to bushing—Infinity

Phase C

Bushing to ground—Infinity
Bushing to ground—Infinity
Bushing to bushing—Infinity

All bushings and bus insulators on important high-voltage transformer units in our plants are cleaned at least once a year on a definite schedule of maintenance for this class of work. They were installed so that certain parts of the buswork and certain transformer banks can be taken out of service long enough for the purpose. We have found that moistening the rags in water and dipping them in a cleaning compound that comes in powder form expedites the cleaning of porcelain bushings and insulators, at least in this part of the country where fog and various acids are present in the atmosphere.

When this cleaning operation is carried on, the various portions of the buswork, bushings, insulator fittings, disconnect hinge pins, and so on, are thoroughly gone over, and the necessary repairs, greasing and oiling are carried out.

Our maintenance crews examine very carefully all lightning arrester installations shortly after each severe electrical storm in this vicinity. In addition, stress is laid on the importance of checking the condition of all lightning arrester grounds and their wires, as well as the ground wires on the frames and tanks of all large rotating electrical equipment and transformer banks.

When Leaks Develop

Oil leaks in large power transformers usually develop at points in the upper part, such as in the joints between cover and tank, in tap-changer stuffing boxes, around the lower clamping rings of bushings, at joints in the circulating pipe between the conservator and tank, or, where oil-filled bushings are used, through the cement that secures the brass terminal cap on the porcelain bushing shell. This last place of leakage seems to be very common and is seldom if ever remedied other than by replacing the entire bushing with a new one, if the leakage is bad.

New bushings are expensive and may not always be immediately available. Furthermore, it may not be possible to remove the transformer from service for the length of time necessary to replace the bushing. An inexpensive and dependable method of repairing leaks involves the use of a mixture of litharge and glycerine to plug up the openings from which the oil is leaking. This repair may easily be made in a short time if the leak is in the upper part of the transformer where

(Continued on advertising page 42)